REPORT TO CONGRESS

ON THE STUDY TO ASSESS SHORT-TERM AND LONG-TERM NEEDS FOR ALLOCATIONS OF ADDITIONAL PORTIONS OF THE ELECTROMAGNETIC SPECTRUM FOR FEDERAL, STATE AND LOCAL EMERGENCY RESPONSE PROVIDERS

Submitted Pursuant to
Public Law No. 108-458

FEDERAL COMMUNICATIONS COMMISSION
Kevin J. Martin, Chairman

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I. INTRODUCTION AND EXECUTIVE SUMMARY

1. This report is submitted by the Chairman, Federal Communications Commission (FCC or Commission),[1] pursuant to Section 7502 of the Intelligence Reform and Terrorism Prevention Act of 2004 (Intelligence Reform Act).[2] The Commission's strategic goal for homeland security is to provide leadership in evaluating and strengthening the nation's communications infrastructure, in ensuring rapid restoration of that infrastructure in the event of disruption, and in ensuring that essential public health and safety personnel have effective communications services available to them at all times, and particularly in the event of an emergency. This report, which reflects analysis undertaken by the Commission staff,[3] is intended not only to address the questions posed by Congress, but also to consider the many thoughtful proposals submitted in the record for addressing the spectrum needs of traditional public safety entities and other critical first responders, as well as some lessons learned from the impact of hurricanes Katrina and Rita on our nation's communications infrastructure.

2. In light of the information in the record and from practical experience wrought from the aftermath of hurricanes Katrina and Rita, this report examines the spectrum needs of traditional public safety entities and other critical first responders. This report also considers proposals to enhance public safety interoperability, particularly broadband interoperability, ranging from the deployment of a nationwide, interoperable network to more easily achievable solutions that employ widely available commercial technologies. Based on a thorough examination of the record in this proceeding, this report reaches the following principal findings, which are discussed in greater detail below and in appendices to this report:

- Emergency response providers would benefit from the development of an integrated, interoperable nationwide network capable of delivering broadband services throughout the country.
- While commercial wireless technologies are not appropriate for every type of public safety communication, there may now be a place for commercial providers to assist public safety in securing and protecting the homeland.
- Prior to undertaking the instant study, the Commission has endeavored to provide adequate spectrum to satisfy public safety's spectrum needs, and the Commission's actions evince its longstanding commitment to working closely with the public safety community to satisfy immediate and short-term spectrum needs.
- While the effort to address the short-term spectrum needs of public safety is underway, attaining a wholesale assessment of long-term spectrum needs is an ongoing task. Mobile, broadband communications, implemented in combination with upgraded equipment, associated training and close coordination, could offer emergency response providers many important capabilities. To this end, and at the urging of public safety, the Commission will expeditiously examine whether certain channels within the current allocation of twenty-four megahertz of public safety spectrum in the 700 MHz band could be modified to accommodate broadband communications.

[1] *See* 47 U.S.C. § 155(a) (stating that "[i]t shall be the [Chairman's] duty . . . to represent the Commission in all matters relating to legislation and legislative reports. . . .").

[2] *See* Pub. L. No. 108-458, 118 Stat. 3638 (2004), codified at 6 U.S.C. § 413.

[3] *See* 47 C.F.R. § 0.331(f) (providing delegated authority to the Wireless Telecommunications Bureau to develop responses to legislative inquiries).

II. BACKGROUND

3. Section 7502 of the Intelligence Reform Act directs that the Commission "shall, in consultation with the Secretary of Homeland Security and the National Telecommunications and Information Administration, conduct a study to assess short-term and long-term needs for allocations of additional portions of the electromagnetic spectrum for Federal, State, and local emergency response providers, including whether or not an additional allocation of spectrum in the 700 megahertz band should be granted by Congress to such emergency response providers."[4] The Intelligence Reform Act also provides that the Commission shall:

> (1) seek input from Federal, State, local, and regional emergency response providers regarding the operation and administration of a potential nationwide interoperable broadband mobile communications network; and
>
> (2) consider the use of commercial wireless technologies to the greatest extent practicable.[5]

Finally, the Intelligence Reform Act requires that "[n]ot later than one year after the date of enactment of this Act, the [Commission] . . . shall submit to the appropriate committees of Congress a report on such study, including the findings of such study."[6]

4. In light of this mandate, on March 29, 2005, the Commission issued a public notice soliciting comment from interested parties regarding the components of the required spectrum needs study.[7] To date, the Commission has received comments from approximately sixty entities, including emergency response providers, critical infrastructure entities, wireless telecommunications carriers, satellite providers, broadcasters, manufacturers and vendors serving the communications industries and others.[8] In addition, the Commission has met with a number of interested parties and received supplementary information on an *ex parte* basis.[9]

5. Currently, more than ninety-seven megahertz of spectrum is allocated in support of

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[4] Intelligence Reform Act at § 7502(a), ALLOCATIONS OF SPECTRUM FOR EMERGENCY RESPONSE PROVIDERS.

[5] *Id*. at § 7502(c)(1)-(2), STUDY REQUIREMENTS.

[6] *Id*. at § 7502(d)(1), REPORTS. Section 7502(d)(2) defines the term "appropriate committees of Congress" to mean
> (A) the Committee on Commerce, Science, and Transportation and the Committee on Homeland Security and Government Affairs of the Senate; and
>
> (B) the Committee on Energy and Commerce and the Select Committee on Homeland Security of the House of Representatives.

[7] Federal Communications Commission Requests Comment on Spectrum Needs of Emergency Response Providers, *Public Notice*, WT Docket No. 05-157, 20 FCC Rcd 7774 (2005). A summary of this notice was published in the Federal Register on April 13, 2005. *See* 70 Fed. Reg. 19467. Unless otherwise noted, the comments and *ex parte* presentations referenced herein are filed in WT Docket No. 05-157.

[8] A listing of parties participating in this proceeding is set forth in Appendix A.

[9] *See, e.g.*, Letter from Michael T. McMenamin, Lucent Technologies, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 05-157 (Nov. 10, 2005) (Lucent Letter); Presentation from Bill Butler, Washington, D.C. Office of Chief Technology Officer, to Angela E. Giancarlo, FCC, WT Docket No. 05-157 (Nov. 4, 2005) (OCTO Presentation); Letter from Ellen M. Kirk, Tropos Networks, to The Honorable Kevin J. Martin, Chairman, FCC, WT Docket No. 05-157 (Nov. 2, 2005) (Tropos Letter).

communications by public safety service providers,[10] as follows:

Frequency Band (MHz)	Megahertz (* denotes approximation)
25-50 (VHF Low Band)	6.3*
150-174 (VHF High Band)	3.6*
220-222 (220 MHz band)	0.1*
450-470 (UHF band)	3.7*
764-776/794-806 (700 MHz band)	24
806-821/851-866 (800 MHz band)	3.5
821-824/866-869 (NPSPAC[11] band)	6
4940-4990 (4.9 GHz band)	50

6. As part of the transition of analog television broadcasting to digital television (DTV), broadcasters currently assigned Channels 60-69 (sixty megahertz of spectrum referred to as the "Upper 700 MHz Band") will be relocated to assignments below Channel 52, which will make this band available for new services. In connection with this action and as mandated by Congress, the Commission allocated

[10] In 1997 amendments to the Communications Act of 1934, Congress defined public safety services as "services – (A) the sole or principal purpose of which is to protect the safety of life, health or property; (B) that are provided (i) by State or local government entities; or (ii) by nongovernmental organizations that are authorized by a governmental entity whose primary mission is the provision of such services; and (C) that are not made commercially available to the public by the provider." 47 U.S.C. § 337(f)(1). The Intelligence Reform Act uses the definition of emergency response providers set forth in the Homeland Security Act of 2002, as follows: "'emergency response providers' includes Federal, State, and local emergency public safety, law enforcement, emergency response, emergency medical (including hospital emergency facilities), and related personnel, agencies, and authorities." 6 U.S.C. § 101(6).

[11] *See* 47 C.F.R. § 90.16 (Public Safety National Plan); *see also* Development and Implementation of a Public Safety National Plan and Amendment of Part 90 to Establish Service Rules and Technical Standards for Use of the 821-824/866-869 MHz Bands by the Public Safety Services, *Report and Order*, GEN Docket No. 87-112, 3 FCC Rcd 905 (1987).

twenty-four megahertz of the Upper 700 MHz Band for public safety services.[12] Additionally, Congress directed that the Commission auction the remaining thirty-six megahertz of the Upper 700 MHz Band for commercial services.[13] At the same time, however, Congress provided that the spectrum would not be available until completion of the digital television transition.[14] As a result, this spectrum is currently not available for public safety use in most areas of the country because of the presence of incumbent television stations. In the meantime, the Commission chartered a federal advisory committee, the Public Safety National Coordination Committee (NCC), to develop operational and technical recommendations for achieving nationwide interoperability in the 700 MHz band. At the recommendation of the NCC, the Commission designated 2.6 megahertz of spectrum for interoperability and adopted Project 25 Phase I as the interoperability digital standard for voice and low speed data communications on the interoperability channels.[15] Further, the Commission required that all narrowband voice and data radios used in the 700 MHz band include the capability of operating on these narrowband interoperability channels.[16] In addition, the Commission reserved 2.4 megahertz of 700 MHz spectrum, designed to support wide-area communications systems and which promotes interoperability, for state use.[17] Accordingly, the Commission is poised to move forward to implement nationwide interoperability for voice and low-speed data communications once these channels are clear and the transition is completed.[18]

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[12] *See* Balanced Budget Act of 1997, Pub. L. No. 105-33, § 3004, 111 Stat. 252 (1997), codified at 47 U.S.C. § 337(a)(1) (Balanced Budget Act).

[13] *See id.* at § 337(a)(2). Initial statutory auction deadlines (which have since passed) were revised by the Auction Reform Act of 2002. *See* Auction Reform Act of 2002 § 203(b), Pub. L. No. 107-195, 116 Stat. 715 (Auction Reform Act) (amending section 309(j) of the Communications Act by adding at the end new paragraph (15)); Auction Reform Act § 3(b) (conforming amendment striking various statutory auction deadlines).

[14] *See* Balanced Budget Act at § 337(a)(2). Congress mandated that the transition from analog to digital television be completed by December 31, 2006, or until eighty-five percent of households in a given area are able to watch digital television programming. Congress envisioned that, until the transition to digital television is complete, television stations would continue to broadcast using both their digital and analog channels.

[15] *See* The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communication Requirements Through the Year 2010, *Fourth Report and Order and Fifth Notice of Proposed Rulemaking*, WT Docket No. 96-86, 16 FCC Rcd 2020 (2001) (*700 MHz Fourth Report and Order*). The public safety spectrum designations in the 700 MHz band are as follows: (1) 12.5 megahertz for general use; (2) 2.6 megahertz for interoperability; (3) 0.2 megahertz for secondary trunking; (4) 2.4 megahertz for state licensing; (5) 0.3 megahertz for low power operations; and (6) 6.0 megahertz is reserved. *See* The Development of Operational, Technical and Spectrum Requirements for Meeting Federal, State and Local Public Safety Communication Requirements Through the Year 2010, *Fourth Memorandum Opinion and Order*, WT Docket No. 96-86, 17 FCC Rcd 4736, 4763 App. D (2002).

[16] *See* 47 C.F.R. § 90.547.

[17] The Commission has granted licenses for the 700 MHz State License channels to all fifty states, as well as the District of Columbia, Puerto Rico, and the U.S. Virgin Islands. In addition to designating specific channels for interoperability, the Commission's rules allow public safety entities to establish a shared communications system or to designate a specific channel for interoperability.

[18] We note that the Commission has taken steps to expedite the digital television transition by providing for all new TV receiver equipment to include digital reception capability as of March 1, 2007. *See* Requirements for Digital Television Receiving Capability, *Second Report and Order*, ET Docket No. 05-24, ___ FCC Rcd ___, FCC 05-190 (rel. Nov. 8, 2005). We further note that the Commission has developed service rules for the non-public safety portion of the Upper 700 MHz band that accommodate new broadcasting, fixed, and mobile services for a broad range of flexible uses. The specific services offered through this band will in large part be determined by the efforts of new licensees to address demands of the communications marketplace. To date, the Commission has conducted (continued….)

7. Simultaneous with the undertaking required by the Intelligence Reform Act, in August and September 2005, hurricanes Katrina and Rita devastated the Gulf Coast. The destruction that hurricane Katrina caused to the facilities of communications companies, and therefore the services upon which citizens rely, was extraordinary. Hurricane Rita, which struck parts of Texas and Louisiana, also caused significant damage to communications facilities. As a result of the respective communications breakdowns, emergency workers and public safety officials had difficulty coordinating. In response to these disasters, the Commission has devoted significant time and resources to enable emergency response providers to communicate. For example, the Commission granted a significant number of requests, including special temporary authorities (STAs), to facilitate communications on the ground. Chairman Martin has established the Commission's Independent Panel Reviewing the Impact of Hurricane Katrina on Communications Networks -- an independent expert panel to review the impact of hurricane Katrina on the communications infrastructure. [19] The panel will be composed of public safety and communications industry representatives, and will make recommendations regarding ways to improve disaster preparedness, network reliability and communications among emergency response providers.

8. In conducting the instant study, the Commission has consulted with the Department of Homeland Security (DHS) and the National Telecommunications and Information Administration (NTIA).[20] At the outset, we note that the Federal Partnership for Interoperable Communications (FPIC), a federal wireless communications technical and operational advisor that includes DHS entities,[21] filed comments in the proceeding, as discussed below. In addition, the Commission's Wireless Telecommunications Bureau (Bureau) hosted two meetings with DHS and NTIA.[22] The Bureau also attended meetings hosted by DHS and NTIA regarding the DHS Spectrum Needs Plan mandated pursuant to Section 2(c) of the November 30, 2004, Executive Memorandum, *Improving Spectrum Management for the 21st Century*,[23] at which DHS provided status reports concerning its corresponding study required under Section 7502(b) the Intelligence Reform Act.[24]

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auctions and awarded licenses for the six megahertz of the Upper 700 MHz band that functions as guard bands between commercial and public safety spectrum.

[19] *See* Chairman Kevin J. Martin Names Nancy J. Victory as Chair of the Federal Communications Commission's Independent Panel Reviewing the Impact of Hurricane Katrina on Communications Networks, *News Release* (Nov. 28, 2005).

[20] *See* Intelligence Reform Act § 7502(a).

[21] *See* FPIC Comments at App. *See also id*. at 2-3 (noting that FPIC was formerly known as the Federal Law Enforcement Wireless Users Group (FLEWUG)).

[22] *See* 47 C.F.R. § 0.131(f).

[23] Section 2(c) requires DHS, in consultation with the Secretary of Commerce and others, by November 30, 2005, to "develop a comprehensive plan, the Spectrum Needs Plan, to address issues related to communication spectrum used by the public safety community, as well as the continuity of Government operations." Presidential Determination: Memorandum for the Heads of Executive Departments and Agencies, Office of the Press Secretary, News & Policies § 2(c) (dated Nov. 30, 2004), located at http://www.whitehouse.gov/news/releases/2004/11/print/20041130-8.html (President's Executive Memorandum). We note that Section 3(b) of the President's Executive Memorandum requires the Secretary of Commerce, by November 30, 2005, to "develop a plan for identifying and implementing incentives that promote more efficient and effective use of the spectrum while protecting national and homeland security, critical infrastructure, and Government services." *Id*. at § 3(b).

[24] Section 7502(b) of the Intelligence Reform Act requires DHS, in consultation with the FCC and NTIA, to "conduct a study to assess strategies that may be used to meet public safety telecommunications needs, including: (1) the need and efficacy of deploying nationwide interoperable communications networks (including the potential technical and operational standards and protocols for nationwide interoperable broadband mobile communications networks that may be used by Federal, State, regional, and local governmental and nongovernmental public safety, (continued….)

9. The discussion set forth below addresses each of the directives in Section 7502 of the Intelligence Reform Act that pertain to the FCC study. First, the report discusses and contains findings regarding the operation and administration of a potential nationwide interoperable broadband mobile communications network. Second, the report discusses and contains findings regarding the use of commercial wireless technologies. The first two areas of inquiry – the need for a potential nationwide interoperable broadband mobile communications network and the use of commercial wireless technologies – are directly related to an assessment of the spectrum needs of emergency response providers. For this reason, the report concludes with a discussion of and findings relating to the short-term and long-term needs for allocations of additional portions of the electromagnetic spectrum for federal, state and local emergency response providers, and whether or not an additional allocation of spectrum in the 700 MHz band should be granted by Congress to these emergency response providers.

III. DISCUSSION

A. Section 7502(c)(i): The Operation and Administration of a Potential Nationwide Interoperable Broadband Mobile Communications Network (Based Upon Input from Federal, State, Local and Regional Emergency Response Providers)

1. Overview

10. With respect to the operation and administration of a potential nationwide interoperable broadband mobile communications network, a number of commenters offer varied objectives and criteria for, as well as potential spectrum requirements associated with, this proposed network. Further, a number of commercial entities report their products could service in place of, or supplement, this potential network. Moreover, a broad array of entities suggests that operating and administrating this proposed network would entail considerable coordination among potential users. Finally, a number of commenters cite the need for Congress to provide the funding necessary to build and deploy this network.

2. Proposals Regarding the Requirements and Architecture of a Potential Nationwide Interoperable Broadband Mobile Communications Network

11. A number of commenters offer varied objectives and criteria for, as well as potential spectrum requirements associated with, a potential nationwide interoperable broadband mobile communications network. First, FCC Regional Planning Committee 8 (RPC 8) asserts that an interoperable nationwide broadband network requires a considerable amount of spectrum dedicated solely to public safety, and "shared by all Government levels."[25] RPC 8 further stresses that the Commission should not permit non-public safety operations in this spectrum, "even on a secondary or shared basis."[26] According to RPC 8, thirty megahertz of spectrum located in the Upper 700 MHz band and currently

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homeland security, and other emergency response personnel); (2) the capacity of public safety entities to utilize wireless broadband applications; and (3) the communications capabilities of all emergency response providers, including hospitals and health care workers, and current efforts to promote communications coordination and training among emergency response providers." Intelligence Reform Act at § 7502(b). The DHS report is also due to Congress by December 17, 2005.

[25] RPC 8 Comments at 11. We note that a Regional Planning Committee (RPC) is responsible for planning, administrating and coordinating the use of public safety spectrum. The Commission adopted a regional planning approach to ensure broad coordination within the public safety community in particular geographic areas of the nation and established fifty-five regions roughly along state boundaries. *See* Development and Implementation of a Public Safety National Plan and Amendment of Part 90 to Establish Service Rule and Technical Standards for Use of the 821-824/866-869 MHz Bands by the Public Safety Services, *Report and Order*, GEN Docket No. 87-112, 3 FCC Rcd 905, 906-12 (1987).

[26] *Id.*

allocated for commercial use would ideally satisfy the requirements for jurisdictional area networks.[27] Similarly, the State of Delaware (Delaware) reports that its strategic plan for the state's first responders and federal and quasi-government partners is "predicated upon the availability of new LMR spectrum in both the 700 MHz and 800 MHz bands."[28]

12. Management Communications Services (MCS), a communications consulting company in Guam, adds that "[i]t is vital that any nationwide broadband mobile communications network for emergency response providers fully incorporate each of the U.S. territories and commonwealths,"[29] and contends that local public safety entities in those jurisdictions must have the ability to communicate with each other and with relevant federal, state, and other local government agencies.[30] In addition, Captain Sonja L. Owens of the Washington, D.C. Metropolitan Police Department (Owens) asserts that emergency response providers' future plans require the national interoperability associated with mobile broadband technologies, as well as the ability to integrate future innovative wireless technologies.[31] More specifically, commenter Andrew Seybold (Seybold) proposes establishing a nationwide Internet Protocol Version 6 (IPv6) network that interconnects "all federal, state and local first responder agencies."[32] Rather than utilize the Internet, Seybold proposes that the proposed nationwide network "should be a new, stand alone system that is secure and built to exacting standards."[33] Seybold proposes that the nationwide IPv6 network would be the "first phase in providing interoperability by cross-connecting [all of the agencies] when working together."[34] Seybold adds that systems existing in the 30, 150 and 450 MHz bands could be connected via a 'Public Safety Internet' in instances where 700 and 800 MHz propagation is not economically feasible.[35]

13. Certain commercial entities report that their products could serve in place of, or supplement, this potential network.[36] First, the Satellite Industry Association (SIA), a trade association representing satellite operators, service providers, manufacturers, and other satellite industry stakeholders, contends that commercial satellite operators offer capabilities that meet critical emergency needs.[37] SIA reports that these capabilities include ubiquitous coverage of land, sky and water, and therefore offer a

[27] *See* RPC 8 Comments at 11-12.

[28] *See* Delaware Comments at 2.

[29] MCS Comments at 2.

[30] *Id*.

[31] Owens Comments at 1. Owens explains that her comments reflect her personal views rather than those of her employer, the Washington, D.C. Metropolitan Police Department.

[32] Seybold Comments at 3. We note that IPv6 is described as the new proposed Internet Protocol designed to replace and enhance the present protocol, TCP/IP or officially IPv4. *See* NEWTON'S TELECOM DICTIONARY 445 (20th ed. 2004).

[33] Seybold Comments at 3.

[34] *Id*. (indicating that "this network [could] be used . . . to provide true interoperability between local agencies on a day-to-day basis").

[35] *Id* at 3.

[36] We note that CTIA expresses support for the goal of a nationwide, interoperable broadband mobile network, and describes the fifty megahertz of spectrum in support of public safety located in the 4.9 GHz band and the twenty-four megahertz of public safety spectrum in the 700 MHz band as suitable for this proposed network. *See* CTIA Comments at 4.

[37] *See* SIA Comments at 3-4

single point of contact for an interoperable communications network.[38] Moreover, SIA asserts that a satellite space infrastructure is immune from natural and manmade disasters.[39] SIA urges the Commission to "solicit comment on the potential for additional government [or] commercial satellite allocations that would allow satellites to communicate directly with existing and planned terrestrial public safety equipment . . . to extend and back-up terrestrial infrastructure during an emergency."[40]

14. In addition, MSS provider Iridium Satellite LLC (Iridium) asserts, "satellite technology should continue to play a critical role in emergency response communications."[41] Iridium adds that its system "is independent from all terrestrial and foreign infrastructure and . . . relies solely on satellite-to-satellite crosslinks to provide voice and data communications anywhere that [DHS], law enforcement, and/or first responders may conduct operations."[42] Iridium contends that this independence allows communications "without having to rely on terrestrial systems that may be destroyed during a disaster."[43] Further, Iridium represents that its system can connect with various other communications networks and thus connect diverse operating organizations on a single network during wide-area missions.[44]

15. Mobile Satellite Ventures Subsidiary LLC (MSV), an operator of Mobile Satellite Service (MSS) in the L-band,[45] also discussed the potential for a nationwide interoperable broadband mobile communications network. MSV emphasizes that an optimal public safety architecture consists of a flexible system that incorporates traditional LMR systems into a broader architecture of satellite, terrestrial and emerging wireless broadband networks.[46] MSV contends that this broader architecture utilizes the MSS ancillary terrestrial component (ATC) and enables users to seamlessly roam between satellite and terrestrial networks.[47] Similarly, TerreStar Networks, Inc. (TerreStar), a prospective MSS provider,[48] asserts that MSS systems, especially those offering an ATC, can provide "ubiquitous, reliable, and interoperable broadband" to emergency response providers.[49] TerreStar adds that with ATC, users may access the network "even in 'urban canyons,'"[50] and explains that public safety agencies have started to incorporate satellite communications into emergency networks.[51] TerreStar also stresses that ATC-

[38] *Id.*

[39] *Id.* at 10.

[40] *Id.*

[41] Iridium Comments at 5.

[42] *Id.* at 2.

[43] *Id.*

[44] *See id.* at 3.

[45] The "L-band" is a general designation for frequencies from 1 to 2 GHz. In the United States, the Commission has allocated L-band spectrum for MSS downlinks in the 1525-1544 MHz and 1545-1559 MHz bands and for MSS uplinks in the 1626.5-1645.5 MHz and 1646.5-1660.5 MHz bands. *See* 47 C.F.R. § 2.106.

[46] *See* MSV Comments at 2-9.

[47] *See id.* at 9-17.

[48] TerreStar is the prospective assignee of the 2 GHz MSS authorization currently held by TMI Communications and Company Limited Partnership. *See* TerreStar Comments at 1, n.1.

[49] *See id.* at 1.

[50] *Id.* at 2.

[51] *See id.* at 2, n.4 (citing the decision of the Connecticut Department of Health to acquire a satellite-based emergency dispatch network).

enhanced MSS can offer public safety agencies affordable access to a satellite network,[52] and reports that "the interoperability of an MSS/ATC system was one of the Commission's principal motivations in allowing MSS providers to integrate ancillary terrestrial capability into their networks."[53]

16. Manufacturers Ericsson, Inc. (Ericsson) and Lucent Technologies, Inc. (Lucent) each submitted a substantial proposal regarding a potential nationwide interoperable broadband mobile communications network. Ericsson contends that public safety agencies should "incorporat[e] commercial wireless technologies into public safety communications networks [to give emergency response providers] the tools to achieve interoperability."[54] Ericsson argues that encouraging the public safety community to establish flexible spectrum management policies would lead to an interoperable nationwide wireless communications network. Ericsson explains that commercially available systems "allow integration of new technologies from multiple vendors and virtually limitless system expansion,"[55] and asserts, "commercial technology is . . . highly interoperable, built to allow communication between multiple networks operating on multiple frequencies and using different technology."[56] Further, Ericsson suggests that public safety agencies should be encouraged to use standardized commercial wireless technologies and systems to the extent commercial solutions meet requirements.[57]

17. Lucent reports that significant work is underway to ensure the coherent integration of "communication stovepipes" to serve the nation's needs.[58] Lucent views this effort as focused primarily on narrowband voice communications, however, and thus submits that, given the importance of IP-based, data driven communications, there should be a similar focus on creating a "National Mobile Broadband Network."[59] Lucent proposes that this "NMBN" operate on a dedicated network in an interoperable manner in order to satisfy emergency responders' need for secure, highly reliable access.[60] Moreover, Lucent contends that the proposed NMBN should not replace current private voice/dispatch networks, but should provide in-field data access to a "trusted information network" of responders.[61] Lucent further proposes that the network employ commercial broadband 3G technology.[62] Lucent claims that its version of a dedicated nationwide interoperable mobile broadband network would perform two essential interoperability functions: (1) act as "universal gateway" for public/private networks using Wi-Fi, Wi-Max, MESH, and satellite technologies; and (2) employ capabilities like the National Incident Management System (NIMS) as a "universal service layer" for transmission of data and VoIP communications.[63]

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[52] *See id.* at 3.

[53] *Id*. at 3, n.6.

[54] Ericsson Comments at 12.

[55] *Id*. at 13.

[56] *Id*.

[57] *See id*. at 19-22 (reporting that "3G systems based on IMT-2000 standards will likewise offer numerous end-user applications . . . for specialized or niche users such as public safety agencies"). *Id*. at 20.

[58] *See* Lucent Comments at 4.

[59] *See id*.

[60] *See id.* at 5-6.

[61] *See id.* at 8.

[62] *See id.* at 19.

[63] *See id*. at 21.

18. Vendors ArrayComm, Inc. (ArrayComm) and Cisco Systems, Inc. (Cisco) also offer proposals regarding a potential nationwide interoperable broadband mobile communications network. ArrayComm, a vendor of smart antennas that employ Time Division Duplex (TDD) technology, asserts that the delivery of data requires a spectrum allocation sufficient to deploy high-speed wireless data services that use TDD.[64] ArrayComm contends that broadband data solutions, including those based on 802.16 and 802.11 protocols, should employ TDD.[65] Cisco asserts that it offers an IP-based product that allows interoperability for emergency personnel using diverse radio and wired communications systems.[66] Cisco contends that this system is spectrum efficient and will accommodate new spectrum allocations and radio technologies as they are implemented, without requiring the replacement of existing radio systems.[67]

19. Finally, Speights Telecom, Inc. (Speights), a public safety consulting company, urges creation of what Speights refers to as a "National IO Band."[68] Speights suggests that this network would add capacity for federal, state and local integrated voice and high-speed data and video, as well as provide compatible equipment designed for mission critical use across the user base. [69] In addition, Speights asserts that a broad base of emergency response providers must have access to the proposed National IO Band, including critical infrastructure entities.[70]

3. Practical Considerations

20. A broad array of entities suggests that operating and administering this proposed network would entail considerable coordination. First, RPC 8 stresses that the proposed network requires "massive cooperation between the Federal, State and Local government layers in order to ensure . . . authentication and security."[71] RPC 8 also recommends that both State Interoperability Executive Committees (SIECs) and RPCs should administer the nationwide network.[72] Similarly, the Missouri State Highway Patrol (Missouri SHP) suggests a role for SIECs "[to] assist local and state entities with introducing and promoting [a] consistent . . . dialogue while providing a sounding board for the development of interoperability requirements within a region or state."[73] Missouri SHP adds that states

[64] ArrayComm Comments at 6.

[65] *See id*. at 4-5. In a TDD system, base station and mobile devices transmit and receive on the same channel but on different time slots. *See id*. at 2.

[66] *See* Letter from Mary L. Brown, Cisco Systems, Inc., to Marlene H. Dortch, Esq., Secretary, FCC, WT Docket No. 05-157 (Dec. 8, 2005).

[67] *Id*. In its comments, Cisco reports that the company has developed an 802.11 product suitable to satisfy the broadband needs of public safety entities. Cisco explains that its Land Mobile Gateway "allows multiple public safety radio networks using different radio frequencies and . . . technologies to interoperate for voice communications." Cisco Comments at 2-3.

[68] *See infra* § II.C.

[69] *See* Speights Comments at 4-5.

[70] *See id.* at 5.

[71] RPC 8 Comments at 4.

[72] *See id*. The Commission has supported the creation of a SIEC (or other effective state level agency) to administer the interoperability channels. Although the formation of SIECs is not mandatory, the Commission adopted the NCC's recommendation that if a SIEC or other state agency elects not to oversee the administration of its interoperability channels, the respective RPC would assume the responsibility. *See 700 MHz Fourth Report and Order*, 16 FCC Rcd at 2026 ¶ 13.

[73] Missouri SHP Comments at 8.

and regions need a national repository within which to post interoperability plans.[74]

21. Vendors Lucent and ArrayComm also provided input on this question. Like RPC 8 and Missouri SHP, Lucent asserts that discrete, regional entities must have responsibility for operating any nationwide interoperable network.[75] In addition, ArrayComm explains, "if the [public safety] user community determines that high speed mobile data should be an integral part of a national or regional public safety system, the Commission should actively assist in" achieving that objective.[76]

22. Broadcaster Univision Communications Inc. (Univision) urges DHS to continue follow recent recommendations that the agency develop a "nationwide database of all interoperable public safety communications frequencies" and "establish a common nomenclature for those frequencies."[77] Univision also asks DHS to: (1) consult with state and local governments to determine interoperability status; (2) provide guidance on funding grants that would assist state efforts to establish responsibility for interoperability matters; (3) approve grants only upon certification by the state that the proposal conforms with state plans; and (4) review interoperability mission and functions.[78]

23. With respect to the interests of Critical Infrastructure (CI) entities, the United Telecom Council (UTC), which represents companies that own, manage, or provide telecommunications and IT systems in support of their core business, endorses a nationwide, interoperable broadband network as a commendable concept, and contends that the network should consist of licensees' systems being shared with other eligibles and using open standards.[79] UTC stresses that "[w]hile public safety response generally is local in nature, CI work during emergencies involves entities from across the country [and] therefore, [t]echnology standards and a nationwide allocation are critical for effective interoperability."[80]

24. A number of commenters suggest that this proposed network would require a significant level of funding from Congress. RPC 8 asserts that a nationwide interoperable mobile broadband network would require significant levels of funding commitments.[81] The New York Office of Technology-Statewide Wireless Network (NYOT-SWN), which is developing a wireless public safety network for the state of New York, states that "[t]he degree to which a wide area interoperable land mobile communications network could be implemented is related to the funding available,"[82] and urges Congress to provide funding.[83] Westchester County, New York (NY Westchester County), a suburban county with a population of close to one million located just north of New York City, reports that, "[b]ecause the absence of adequate financial resources is such a threat to progress,"[84] Congress should create trust funds for advancing the nation's communications infrastructure. Missouri SHP proposes that users recoup the costs of constructing a nationwide network through subscriber fees based on usage, and

[74] *See id*.

[75] *See* Lucent Comments at 20.

[76] ArrayComm Comments at 6.

[77] Univision Comments at 7, n.14.

[78] *See id.* at n.14.

[79] *See* UTC Comments at 12-13.

[80] *Id*. at 13.

[81] *See* RPC 8 Comments at 4.

[82] NYOT-SWN Comments at 5.

[83] *See id*.

[84] NY Westchester County Comments at 9.

adds that an oversight committee could ensure affordable pricing for access.[85]

25. The Information Technology Industry Council (ITIC), which represents IT product and service providers, also urges Congress to provide funding, stating that "[p]ublic safety lacks much of the funding needed to achieve nationwide interoperability."[86] ITIC reports that cost estimates for interoperability range from several billion dollars over five to ten years, to $18.3 billion for replacement of existing infrastructure.[87] The First Response Coalition (FRC), a non-profit organization that educates the public on first responder needs, reports that by 2008, emergency response providers will face a $100.2 billion shortfall, and urges Congress to provide federal funding.[88] In addition, T-Mobile USA, Inc. (T-Mobile), a nationwide wireless carrier, states, "the government should consider allocating more funds to upgrade outdated equipment [that uses] spectrally inefficient analog technology."[89] Similarly, MSV states, "many jurisdictions lack the funds to upgrade their [old] systems . . . , and more fundamentally, are unable to plan effectively their wireless needs."[90] Finally, Univision also cites a lack of funding as a major obstacle to interoperability.[91]

4. Findings

26. Emergency response providers would benefit from the development of an integrated, interoperable nationwide network capable of delivering broadband services throughout the country. A network that delivers real-time, high speed, highly secure broadband data to emergency response providers in the field would improve their ability to respond to emergencies. The benefits associated with a nationwide interoperable broadband mobile communications network include:

- delivery of rapid warnings and messages pertaining to criminal activity, including AMBER Alerts;[92]
- video surveillance during emergency incidents;
- real-time text messaging and e-mail;
- delivery of high resolution digital images; and
- the ability to obtain location and status information of personnel and equipment in the field.

27. A nationwide interoperable broadband mobile communications network could potentially include the use of "smart radios," which are capable of operating on multiple

[85] *See* Missouri SHP Comments at 13

[86] ITIC Comments at 8.

[87] *See id.* at 8-9.

[88] *See* FRC Comments at 6-7.

[89] T-Mobile Comments at 3

[90] MSV Comments at 5.

[91] *See* Univision Comments at 7-8.

[92] AMBER (America's Missing: Broadcast Emergency Response) Alerts are a component of the Emergency Alert System and consist of emergency messages broadcast when a law enforcement agency confirms a report that a child is missing and in imminent danger. The law enforcement agency sends the AMBER Alert to radio stations, television stations, and cable companies. The emergency broadcasts include information about the child, the suspected abductor, and details of the abduction. AMBER Alert messages also provide information on how members of the public with information relating to the abduction may contact the police or other appropriate law enforcement agency.

frequencies in multiple formats, so that different systems can connect with each other. Properly implemented, a system with adequate spectrum and smart radios would enhance the instantaneous transmission of both data and voice between agencies.

28. The underlying infrastructure of a nationwide interoperable broadband mobile communications network should include a mobility and satellite component to enable emergency response providers the capability of "rolling in" a mobile infrastructure that would quickly re-establish communications when permanent networks are temporarily incapacitated. Mobile antennas, including inflatable antennas, cell towers on wheels, high-altitude balloons, or other mobile facilities, would operate independent of the damaged local infrastructure and would facilitate communications as quickly as possible. Mobile transmission facilities would bring the critical flexibility component to a nationwide interoperable broadband mobile communications network, and would serve to augment the system beyond the normal coverage in a given region, or during a large-scale incident. Additional details regarding smart radios, mobile infrastructure and other commercial wireless technologies and services are set forth in Appendix B.

29. A robust interoperable network (whether commercial or private) should be able to function in all areas served by emergency response providers, including areas where most of the communications infrastructure is degraded or non-existent. Satellite services, which provide ubiquitous, reliable coverage throughout the United States and are generally immune from natural and manmade disasters, could be incorporated into traditional, private public safety networks or into a nationwide network. Additional details regarding the use of commercial satellite infrastructure for the provision of emergency communications are set forth in Appendix C. Likewise, IP-based technologies also may enhance the resiliency of either traditional, private public safety networks or a nationwide network by providing the dynamic capability to change and reroute telecommunications voice and data traffic within the network. Similarly, IP-based systems may also facilitate communications interoperability for emergency response providers generally, as well as their ability to communicate complex information between offices and the field. Other commenters point out that wireless mesh technology, which uses non-proprietary protocols that can be built into laptops, Personal Digital Assistants (PDAs), VoIP phones and other devices to promote interoperability across networks and devices. Appendix B also discusses mesh networks and IP-based systems.

30. In addition to adequate spectrum and efficient technology, the realization of a nationwide interoperable broadband mobile communications network also would require sufficient funding. While of significant benefit to public safety, implementation of such a network would likely be costly. Consequently, public safety entities would require adequate funding resources in order to deploy broadband communications systems. Without adequate funding – to purchase equipment and conduct the associated training and coordination – it is likely that public safety would be unable to implement a nationwide, interoperable broadband network. In addition, absent adequate funding, cash-strapped public safety entities could implement broadband systems that are less capable and efficient and do not include a nationwide interoperable feature, which could create gaps in a nationwide system.

31. In addition to the issues discussed above, we emphasize that the successful deployment of a nationwide interoperable broadband mobile communications network ultimately would be dependent upon a high degree of training, coordination and communication by emergency responders. Close organizational and personal coordination and communication would be necessary to make interoperable communications available in the times of greatest need. Coordination among federal, state and local emergency response providers would need to be achieved at virtually every level for an interoperable nationwide network to deliver on its promise. Emergency response providers must be familiar with the procedures for accessing the network and the capabilities of the communications equipment associated with the network. In particular, command level coordination should be emphasized. In all cases, the rights and responsibilities of each of the various stakeholders should be clearly defined to ensure seamless communications and facilitate compliance efforts.

B. Section 7502(c)(ii): Consider the Use of Commercial Wireless Technologies to the Greatest Extent Practicable

1. Overview

32. With respect to the use of commercial wireless technologies, public safety entities generally oppose reliance upon commercial services due to concerns over lack of coverage, reliability and security. There is a consensus among these entities, however, that commercial technologies may provide significant benefits, at least for non-mission critical applications. In some instances, commercial entities proactively address these concerns and assert a willingness to modify applications to resolve past deficiencies. The commercial entities also emphasize the beneficial economies of scale associated with greater use of commercial services and technologies.

2. Comments from Public Safety Entities

33. With respect to public safety entities, the Arizona Regional Review Committee (ARRC), an organization responsible for public safety spectrum planning in RPC 3, submits, "[l]ack of suitable spectrum has forced many public safety entities to use the resources of commercial wireless providers, … a dangerous practice that has continued to expand and spread."[93] ARRC contends, "[c]ommercial wireless providers favor the masses and do not lend themselves to the same backup power, site security and redundancy measures employed by dedicated and closed public safety radio networks."[94] Similarly, RPC 12 states that it repeatedly observes commercial wireless technologies rendered inoperable during critical events when reliance is most critical.[95] The group provides examples of events, such as the September 11th terror attack in New York City, the Oklahoma City bombing, and the Florida hurricanes in 2004, when commercial systems failed, "in some cases for many weeks."[96] With regard to these challenges, the National Emergency Management Association (NEMA) submits that the use of commercial wireless technologies has two drawbacks: (1) a lack of support from generators during power outages, and (2) a limited footprint, which provides little coverage in rural areas.[97]

34. Similarly, the Commonwealth of Pennsylvania, Office of Public-Safety Radio Services (Penn. Public Safety) favors statewide systems that "provide the economy of scale and spectral efficiency of a commercial operation, while maintaining system control under governmental authority."[98] In its brief comments, the Grundy County Emergency Telephone System (Morris, Illinois) (Grundy County) states, "public safety cannot rely on unlicensed or commercial technologies to meet [its] mission critical broadband applications,"[99] and submits that "experience shows that only dedicated communications systems designed specifically for public safety needs provide the reliability, features and flexibility [necessary] for critical internal communications."[100] The Milwaukee Police Department (Milwaukee PD) also states that "[c]ommercial service does not provide reliability and security necessary for mission critical . . . use."[101] Milwaukee PD submits that "variants of 802.11 work, but demand heavy

[93] ARRC Comments at 2.

[94] *Id.*

[95] RPC 12 Comments at 3.

[96] *Id.*

[97] NEMA Comments at 2.

[98] *See* Penn. Public Safety Comments at 7.

[99] Grundy County Comments at 1.

[100] *Id.*

[101] Milwaukee PD Comments at 1.

infrastructure investment due to limited range of 2.4 and 5.8 GHz allocations,"[102] and therefore suggests that emergency response providers need a "high-speed wireless service, under their control, that provides reliability and security . . . in a spectrum more conducive to wide area coverage."[103] Finally, the City of Seattle (Seattle) reports the use of commercial services, which are not designed for high throughput applications or high capacity, large-scale emergencies, represent a significant expense.[104] Moreover, Seattle contends that the requirements for interoperable communications – high-speed data, VoIP, and video – "will far exceed the current data service infrastructure provided by third party commercial providers."[105]

35. A number of public safety and other entities report that commercial technologies may provide benefits for non-mission critical applications. With respect to state and local agencies, the California Highway Patrol (CHP) asserts that emergency response providers "would benefit from accessing existing wireless and public service communications networks to enhance essential communications links within regional public safety agencies."[106] The Florida Department of Transportation (FDOT) states that it supplements its internal communications with commercial wireless service, however, the agency emphasizes that it "cannot consider commercial wireless service for primary mission critical communications [because] attempts in using commercial service proved unreliable during the four hurricanes . . . in 2004."[107] Missouri SHP recognizes that "[c]ommercial technologies will be utilized in many public safety applications, particularly in the new 4940-4990 MHz band, provided they are designed, implemented and *intended* to provide public safety coverage."[108] Missouri SHP adds, "public safety coverage requirements have to be considered in any design and implementation, which utilizes 'commercial technologies.'"[109] NYOT-SWN asserts that the use of advanced commercial technologies for non-mission critical tasks may significantly improve mobile data communications to the extent that public safety receives broadband spectrum allocations.[110] Similarly, NY Westchester County states that the "use of commercial services to supplement the capabilities of dedicated public safety systems may be appropriate, but only when it is strictly limited to non-critical applications."[111] Owens reports that the "future needs of emergency response providers will require national interoperability of broadband mobile communications, along with the ability to grow with future developments in wireless technologies fueled by both public sector and commercial entities."[112]

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[102] *Id*.

[103] *Id*.

[104] *See* Seattle Comments at 1.

[105] *Id*.

[106] CHP Comments at 1.

[107] Florida DOT Comments at 5-6.

[108] Missouri SHP Comments at 10 (emphasis in original).

[109] *Id*.

[110] *See* NYOT-SWN Comments at 6. NYOT-SWN also recognizes that these "networks are generally subject to unpredictable service outages due to traffic overload, severe weather conditions, labor strikes and other business disruptions." *Id*.

[111] NY Westchester County Comments at 6. We note that NY Westchester County describes the Capital Wireless Integrated Network (CapWIN), an application that offers interoperable first responder data communication and information sharing, as an "enormous success … even though … dependent upon a variety of commercial communications services." *Id*. at 5. CapWIN is discussed in Appendix D.

[112] Owens at 1.

36. The Spectrum Coalition for Public Safety (Spectrum Coalition), a non-commercial affiliation of thirty state, county and local government public safety organizations, asserts that commercial technologies provide significant benefits, including roaming, but "may require some modification to accommodate the public safety environment, supporting full ruggedization, enhanced uplink performance, [and] easily deployed vehicular transceiver systems."[113] The coalition also suggests that that carriers could operate or lease back the networks built for public safety use, and these approaches would leverage expertise and share costs while allowing control by public safety.[114] The Spectrum Coalition stresses, however, that relying completely on commercial providers for wireless broadband would require frequent, costly equipment change-outs given that commercial carriers modify and upgrade technologies relatively frequently.[115]

37. Finally, UTC notes that CI entities report their desire to build and operate systems that employ "multiple new technologies that can be used for upgraded services for *private, internal* applications."[116] UTC cautions that commercial technologies are desirable where feasible, but commercial providers cannot meet critical criteria of reliability and ubiquity across service territories that include rural areas.[117] Seybold similarly contends that commercial networks are suitable only for secondary public safety communications and not for mission-critical dispatch operations.[118] Seybold adds that first responder networks cover areas that commercial networks do not, and that recent local regulatory decisions limit construction of new cell sites.[119] Likewise, commenter Andy Middlebrooks (Middlebrooks) reports that commercial wireless technologies are suitable for "some secondary" public safety communications.[120] Finally, the Progress and Freedom Foundation (PFF), a non-profit, non-partisan research institution, suggests that giving public safety licensees expanded rights to the spectrum they hold would provide these entities an opportunity to lease their spectrum on an "interruptible" basis while simultaneously retaining the right to use the spectrum in an emergency.[121]

3. Comments from Commercial Entities

38. A number of commenters report general support for the use of commercial wireless technologies by emergency response providers. For instance, communications equipment manufacturer Motorola, Inc. (Motorola) states, "commercial services could be used for non-mission critical activities like communicating with the public or administrative and government services requirements,"[122] but notes the lingering need for dedicated systems to provide "the appropriate reliability, features, and flexibility

[113] Spectrum Coalition Comments at 9.

[114] *See id.* at 11.

[115] *Id*. at 10. We note that we received additional data described as an update to the previous filing of the Spectrum Coalition and pertaining to spectrum needs of emergency response providers in the National Capital Region on December 14, 2005. *See* Letter from Robert LeGrande II, Deputy Chief Technology Officer, D.C. Government, to Marlene H. Dortch, FCC, WT Docket No. 05-157 (Dec. 15, 2005).

[116] UTC Comments at 12 (emphasis in original).

[117] *See id.* at 12-13.

[118] *See* Seybold Comments at 2.

[119] *See id*.

[120] *See* Middlebrooks Comments at 2.

[121] *See* PFF Comments at 5.

[122] Motorola Comments at 8.

needed by" public safety.[123] CTIA – The Wireless Association (CTIA), which represents carriers and manufacturers in the wireless communications industry, reports, "emergency response providers should continue to expand their use of commercially-supplied systems to the extent feasible."[124] CTIA suggests that emergency response providers contract with commercial providers to utilize part of a commercial network for specific needs, especially in instances when circumstances warrant special capabilities not generally available to consumers.[125] Similarly, Enterprise Wireless Alliance (Enterprise), an association comprised of private wireless spectrum users, wireless service providers, radio dealers and technology manufacturers, contends that commercial systems currently approximate the coverage necessary for robust public safety operations due to improved technologies, as well as local radio dealers' increased willingness to tailor systems to suit public safety needs.[126] Finally, the Telecommunications Industry Association (TIA), which represents manufacturers serving the information and communications industries, emphasizes that ubiquitous commercial provider networks can play a significant role, providing public safety agencies mechanisms for leveraging the benefits of those networks, including wireless broadband.[127] TIA states, "[p]ublic safety agencies should be encouraged to explore the use of widely-available, standardized commercial wireless technologies (within the spectrum allocated for public safety services) even for mission-critical needs."[128]

39. Bizcom USA, Inc. d/b/a CX2Technologies (CX2), a licensee in the 200 MHz band, proposes public safety use of the 220-222 MHz band for data transport. CX2 reports that this band "exhibits characteristics which make it ideally suited for public safety use and should be considered an integral part of any plan to meet spectrum needs for public safety,"[129] and that there are frequencies in the 220-222 MHz band available for land mobile and fixed use for both government and non-government operations.[130] CX2 contends that the band is an excellent option for data networks addressing public safety needs, and asserts that the planned narrowband network will not compete for bandwidth with public safety requirements for two-way voice, paging or cellular service.[131] CX2 also asserts that its network offers a more expansive coverage footprint than other bands due to the lower frequency and lower foliage absorption of the RF signal and "could satisfy the data component of public safety strategy … leaving the voice and video applications to other networks."[132]

40. Ericsson contends that incorporating the use of commercial wireless handsets and other commercial wireless technologies into public safety communications networks will give emergency responder providers tools to achieve interoperability through the use of commercial handsets.[133] Ericsson states that an emergency response provider "could deploy a commercial system in public safety spectrum which would provide interoperability with other public safety and commercial networks, widespread

[123] *Id.*

[124] CTIA Comments at 6.

[125] *Id.*

[126] *See* Enterprise Comments at 6-7.

[127] *See* TIA Comments at 5

[128] *Id.*

[129] CX2 Comments at 4.

[130] *See id.*

[131] *See id.* at 7-8.

[132] *Id.* at 7.

[133] *See* Ericsson Comments at 12-13.

coverage, multiple levels of priority access to spectrum, and secure voice and data transmission."[134] Ericsson adds that emergency response providers or commercial entities or both could own or manage this type of system.[135] Similarly, Qualcomm, Incorporated (Qualcomm) submits that commercial technologies would benefit emergency response providers "in countless ways."[136] Qualcomm asserts, for example, that EV-DO (EVolution-Data Optimized) technologies enable commercial carriers to deliver ubiquitous, advanced, high-speed broadband.[137] Qualcomm contends, "[e]mergency responders can use these interoperable networks for critical information sharing."[138] Qualcomm further suggests that its Forward Link Only (FLO) technology is suitable for public safety application in the lower 700 MHz band and reports its intention to launch "MediaFLO" service -- a nationwide network on 700 MHz spectrum, Channel 55, to deliver multimedia content to wireless phones.[139]

41. PacketHop, Inc. (PacketHop), a developer of mobile mesh networking software, contends, "[u]se of standards-based commercial technologies will allow first responders and public safety personnel to reap the benefits of changing technical capabilities and new standards."[140] PacketHop adds that widespread use of commercial technologies would render products affordable and "maximizes the number of first responders that can benefit from services using the spectrum."[141] PacketHop advocates that use of commercial off-the-shelf equipment and wireless protocols would allow broadband communications using Wi-Fi capabilities in the 4.9 GHz band as hardware becomes available.[142]

42. In addition, Access Spectrum, L.L.C. (Access Spectrum) and Pegasus Guard Band, L.L.C., (Pegasus) licensees of spectrum in the Upper 700 MHz band, jointly filed a white paper in the instant docket, which proposes several options for rebanding the 700 MHz band.[143] Specifically, Access Spectrum and Pegasus jointly assert that a "'mixed-use' block of spectrum, designed to be used by both public safety agencies and commercial users, may bring the benefits of broadband to the public safety community in an expeditious and cost-effective manner while protecting public safety operations against interference from commercial operations."[144] The entities submit that "modern prioritization and virtual private network technology could provide public safety traffic the highest priority on shared-use commercial wireless networks."[145] Access Spectrum and Pegasus emphasize that, implementing these

[134] *Id*. at 13.

[135] *See id*.

[136] Qualcomm Comments at 6.

[137] *See id.* at 6-8.

[138] Qualcomm Comments at 7. "The CDMA 2000 technologies include 1xEV-DO, the first version of which 1xEV-DO Release O, enables wireless downloads over licensed spectrum over average rates of hundreds of kilobits per second and peak rates of 2.4 megabits per second." *Id.* at 6.

[139] *See id*. at 8.

[140] PacketHop Comments at 4.

[141] *Id*. at 3.

[142] *See id*. at 3-4.

[143] *See* Letter from Kenneth R. Boley, counsel to Access Spectrum, L.L.C., to Marlene H. Dortch, Secretary, FCC, WT Docket No. 05-157 (Aug. 3, 2005) (appending White Paper, *Implementing the Vision for 700 MHz: Rebanding the Upper 700 MHz A and B Blocks For Next-Generation Wireless Broadband*) (Access Spectrum and Pegasus White Paper).

[144] Access Spectrum and Pegasus at 18.

[145] *Id*.

technologies would potentially permit public safety entities to "share with commercial users the costs of deploying next-generation wireless broadband infrastructure while still getting . . . priority and security."[146]

43. On the other hand, consulting firm Interoperable Wireless contends commercial wireless systems would require "hundreds of megahertz of spectrum" to achieve the quality of service expected by public safety.[147] According to Interoperable Wireless, a significant amount of spectrum is necessary to meet public safety's unusual requirements because, as compared to a standard commercial wireless call that consists of one person communicating to another, public safety calls "may *average* one hundred users."[148] Interoperable Wireless therefore suggests that commercial technologies are not suitable for public safety because commercial technologies would require use of "at least two megahertz of spectrum" to provide communication to and among a large group.[149]

44. Finally, with respect to economic benefits associated with the use of commercial wireless technologies, CTIA suggests that public safety entities will benefit from synergies in economies of scale and equipment advances given that the twenty-four megahertz in the 700 MHz band allocated for public safety is proximate to the thirty-six megahertz allocated for commercial use.[150] CTIA further notes that the twenty-four megahertz in the 700 MHz band is proximate to newly cleared, consolidated spectrum available for public safety in the 800 MHz band.[151] Satellite service provider MSV contends that the use of MSS, in combination with the ancillary terrestrial component, would assure ubiquitous coverage, would more economically cover remote areas, and unlike most commercial networks, would be reliable when the power grid fails.[152] Enterprise stresses that the cost of commercial services has decreased and reports that SouthernLINC Wireless's "advanced network has allowed public safety entities to avoid the costs involved in constructing and maintaining their own systems."[153]

4. Findings[154]

45. While commercial wireless technologies are not appropriate for every type of public safety communication, there may now be a place for commercial providers to assist public safety in securing and protecting the homeland. Technological solutions are emerging that show significant promise for addressing interoperability, a multi-faceted concept that occurs across what DHS has dubbed the "interoperability continuum."[155] Various commercial wireless technologies and services – from those

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[146] *Id*.

[147] Interoperable Wireless Comments at 18.

[148] *Id*. (emphasis in original).

[149] *Id*. at 19.

[150] *See* CTIA Comments at 5-7.

[151] *See id.* at 5.

[152] *See* MSV Comments at 11.

[153] Enterprise Comments at 5.

[154] As noted in this report and as discussed in greater detail in the appendices, the use of commercial technologies, appropriately implemented, may provide significant benefits to emergency response providers. *See* Appendix B (discussing commercial wireless technologies and services) and Appendix C (discussing commercial satellite technologies and services).

[155] *See* http://www.safecomprogram.gov/NR/rdonlyres/72E16B22-6928-4676-A82A-B6858E7974FA/0/InteroperabilityContinuum.pdf; *see also* Presentation from Bill Butler, Washington, D.C. Office of Chief Technology Officer, to Angela E. Giancarlo, FCC, WT Docket No. 05-157 (Nov. 4, 2005) (OCTO (continued….)

that achieve a minimum level of interoperability to those that achieve an optimal level – are available to provide public safety with solutions at every step of the interoperability continuum.

46. It is important to note that there is a distinction between suggesting that public safety consider the use of commercial services and exploring the utility of deploying commercial technologies in public safety spectrum. In general, public safety commenters have expressed reluctance to rely on commercial services for mission critical communications because of lack of network control, security and reliability concerns, particularly during a crisis or disaster. Public safety commenters also noted that commercial service networks often provide only limited coverage in rural areas. Incorporating commercial technologies into networks operated by public safety may provide numerous benefits to the public safety community in terms of cost, access to technological advances and efficient spectrum use. Commercially proven, high-speed mobile data technologies can enhance public safety capabilities in both a timely and cost-effective manner. As to timeliness, public safety would benefit because technologies are already widely available in the commercial marketplace. Given this wide availability, therefore, public safety entities would benefit from the associated economies of scale in purchasing equipment and facilities. Further, given that certain of these technologies operate on non-proprietary standards, public safety entities would be in a better position to take advantage of technological upgrades.

47. For example, smart radios are capable of operating on multiple frequencies in multiple formats so that different systems can connect with each other. IP-based systems are capable of enabling communications between diverse radio systems and frequencies without requiring the replacement of existing radios. These systems interconnect emergency personnel and other resources across existing radio networks and other communications networks, and thus can achieve immediate interoperability of existing push-to-talk radio systems operating in separate spectrum bands as well as commercial voice and broadband systems. Wi-Fi and Wi-Max technologies permit emergency response providers to communicate information between offices and the field, which is especially helpful in non-mission critical situations. Other commercial wireless services, including Wireless Priority Service (WPS), as well as cellular technologies that enable easy one-to-one and one-to-many half-duplex communications (*e.g.*, "Push-to-Talk") also may further the ability of emergency response providers to effectively communicate with each other. At a minimum, public safety entities may realize many benefits from entering into partnerships with commercial providers, especially with respect to non-mission critical duties, that allow public safety to leverage technological advances and increased competition.

48. Further, the incorporation of commercial satellite services into either a private public safety or commercial interoperable network that also includes terrestrial wireless systems would help to ensure that effective communication services are available to emergency response providers. Federal, state and local emergency response providers are already using commercial satellite services either as stand-alone platforms or as part of an integrated satellite terrestrial network to enable a range of voice, data, video and other services.

49. Finally, given the impact of hurricane Katrina on the communications infrastructure in the affected area, and the larger recognition that disasters often render communications infrastructure inoperable, an independent expert panel composed of public safety and communications industry representatives will analyze and make recommendations to the Commission regarding ways to improve network reliability, among other issues.[156] Hurricane Katrina severed communications links to multiple Public Safety Answering Points (PSAPs), the key facilities that handle local emergency and first responder calls. Going forward, we need to establish a process to work with states and municipalities to

(Continued from previous page)
Presentation) (depicting the continuum of public safety wireless communications interoperability capabilities in the Washington, D.C. area); Motorola Oct. 27, 2005 *Ex Parte* (APCO Supported Interoperability Options).

[156] *See infra* ¶ 7.

improve the redundancy of critical communications links that serve PSAPs. As part of this effort, the federal government should take a lead role to facilitate and encourage cooperation among local jurisdictions to address mutual restoration and redundant routing that will help create a more resilient network to aid emergency response providers.

C. Section 7502(a): The Short-Term and Long-Term Needs for Allocations of Additional Portions of the Electromagnetic Spectrum for Federal, State and Local Emergency Response Providers, and Whether or Not an Additional Allocation of Spectrum in the 700 Megahertz Band Should be Granted by Congress to Federal, State and Local Emergency Response Providers

1. Overview

50. With respect to short-term and long-term needs for allocations of additional spectrum for federal, state and local emergency response providers, we initially note that while the completion of the DTV transition will provide a significant benefit to public safety entities, there are also a number of other initiatives underway to address public safety's immediate spectrum needs. For example, the Commission has taken a number of actions to improve public safety communications in the 800 MHz band, as well as to promote the more efficient use of existing public safety spectrum.

51. In considering public safety's short-term and long-term needs, a number of commenters urge a broad interpretation of the definition of "emergency response providers." In connection with the inquiry, public safety and CI commenters generally contend that, even with the actions the Commission has taken to date, there is a need for additional public safety spectrum in the 700 MHz, 800 MHz and 4.9 GHz bands. These entities describe a need for more spectrum in the 700 MHz band to implement broadband data applications.

52. With respect to whether or not Congress should grant an additional allocation of spectrum in the 700 MHz band to federal, state and local emergency response providers, commenters favoring additional public safety spectrum cite increased demands on emergency response providers and urge Congress to grant additional allocations of ten to thirty megahertz of spectrum in the 700 MHz band. Certain commenters ask Congress to grant additional allocations of spectrum in the 700 MHz band, but do not specify an amount. In addition, some commenters urge Congress to grant additional allocations of public safety spectrum in bands other than the 700 MHz band. Finally, citing the need for spectral efficiency, a number of commenters argue that Congress should refrain from granting additional spectrum in the 700 MHz band until that band is cleared and services operating on the twenty-four megahertz public safety spectrum allocation are deployed. Wireless carriers, broadcasters, manufacturers and vendors generally assert that public safety entities must use spectrum more efficiently. In this regard, these entities argue that the existing 700 MHz allocation must be cleared and put to use prior to consideration of allocation of additional public safety spectrum and that public safety agencies do not need additional spectrum in the short-term.

2. Status of the 700 MHz Band

53. At the outset, we note that a broad array of entities urge Congress to establish a firm date for broadcasters to clear Channels 60-69 in order to make available for public safety the spectrum associated with these channels. This discussion, along with a short summary of Congress' recent activities in this area, follows.

54. A number of public safety commenters (and their representatives) urge expeditious clearing of the 700 MHz band. For instance, NEMA complains that the uncertain status of the spectrum "has compelled some states to purchase radios that work in both the 700 and 800 MHz bands."[157] The

[157] NEMA Comments at 2.

Spectrum Coalition supports "a date-certain for DTV transition, because without clearance of the analog TV signals, the spectrum will not be available for *any* use."[158] The FRC reports that additional spectrum is crucial to achieving interoperability, and urges the Commission to ask Congress to accelerate the DTV transition by establishing a date certain for clearing the 700 MHz band.[159]

55. Penn. Public Safety observes that emergency response providers cannot access the public safety spectrum in the 700 MHz band until analog broadcasting ends and television channels are available.[160] Penn. Public Safety explains that the uncertainty surrounding the lower television channels has delayed the ability of RPCs 28 and 36 to undertake meaningful spectrum planning.[161] The Michigan Department of Information Technology (MDIT) urges Congress to expedite the availability of the 700 MHz band.[162] Milwaukee PD asserts, "[v]irgin spectrum that can be rationally appropriated with wide area interoperability in mind demands the 700 MHz allocations be cleared as soon as possible."[163] Grundy County contends that Congress and the Commission must take action this year to set a date certain to clear the 700 MHz band.[164]

56. Certain public safety commenters urge that Congress establish a firm deadline by which the 700 MHz band be cleared. For instance, RPC 8 urges Congress "to set a date certain deadline to move all existing analog TV stations on Channels 60 through 69 off the air no later than January 2006."[165] NYOT-SWN reports, "the [DTV] transition must be completed on its original schedule - December 31, 2006, with *no exemptions*."[166] The City of New York (NYC) maintains that Congress should mandate clearing the spectrum by 2007 or very soon thereafter.[167] Similarly, FDOT submits that "any timetable much beyond the contemplated December 31, 2006 objective for clearing the band . . . will severely strain the operations of FDOT and other Florida emergency response providers with the result that pent-up demand for spectrum may affect available capacity."[168]

57. CTIA and T-Mobile also urge expeditious clearing of the 700 MHz band. CTIA "encourages the Commission . . . to support clearing the [700 MHz] spectrum as quickly as possible."[169] T-Mobile adds, "[t]he real obstacle to public safety operations is not inadequate spectrum allocation in the 700 MHz . . . , but rather the inability of public safety licensees to commence operations in the band at all."[170]

58. Finally, a number of communications industry manufacturers and vendors assert that

[158] Spectrum Coalition Comments at 8 (emphasis in original).

[159] FRC Comments at 4-5.

[160] Penn. Public Safety Comments at 3.

[161] *Id*. at 3.

[162] *See* MDIT Comments at 2.

[163] Milwaukee PD Comments at 1.

[164] Grundy County Comments at 1.

[165] RPC 8 Comments at 8.

[166] NYOT-SWN Comments at 2-3 (emphasis in original).

[167] NYC Comments at 3.

[168] FDOT Comments at 6.

[169] CTIA Comments at 5.

[170] T-Mobile Comments at 3.

Congress must act to clear the 700 MHz band prior to making allocations of additional spectrum, and urge Congress to establish a firm deadline for clearing the band. For example, ITIC argues that the "opportunity cost of *not* promptly clearing the 700 MHz band of legacy analog television stations currently encumbering Channels 62-69 is enormous because expeditiously clearing . . . the 700 MHz band would greatly advance spectrum efficiency."[171] TIA "strongly urges the Commission to support a date certain of December 31, 2006."[172] In addition, M/A-COM Corporation (M/A-COM), a developer and manufacturer of semiconductors and technologies serving the public safety and CI industries, reports that "large swaths" of the ninety-seven megahertz of spectrum designated by the Commission to support public safety communications remain unavailable.[173] In this regard, M/A-COM suggests that the Commission work with Congress to "identify December 31, 2006, as [the] final deadline for the switchover to DTV."[174] Although Motorola supports the imposition of a date certain, the company submits that the December 31, 2006, transition date remains unlikely given the "loophole . . . allowing TV broadcasters to remain indefinitely based on DTV availability."[175] Finally, Qualcomm urges Congress to expedite clearing of all spectrum in the 700 MHz band by firmly establishing a "hard date of December 31, 2006," for the end of the DTV transition.[176]

59. On the other hand, two broadcasters allege that no reason to expedite clearing the 700 MHz band exists. First, Maranatha Broadcasting Company (Maranatha), which serves the Philadelphia area, contends that there is not "any short-term need for access to the [700 MHz] band whether by December 31, 2006 or, probably December 31, 2010, because the public safety agencies in its broadcasting service area have no short-term plans for new systems in the Upper 700 MHz band."[177] Second, Univision cautions that proposals allowing public safety entities to begin planning for use of the twenty-four megahertz of spectrum set aside for public safety would dislocate up to seventy-five broadcast stations and "would be unfair to the broadcasters and their viewers."[178] These stations, Univision notes, also broadcast weather, traffic, disaster, and other safety alerts, each of which is critical to public safety.[179]

60. We note that Congress is actively considering legislation that would revise the timeline for completion of the digital television transition.[180] The current target for completion of the transition is the earlier of December 31, 2006, or when eighty-five percent of households are able to receive a digital

[171] ITIC Comments at 9-10 (emphasis in original).

[172] TIA Comments at 4.

[173] *See* M/A-COM Comments at 3.

[174] *Id*. at 4.

[175] Motorola Comments at 5; *see also id.* at 4 (asserting that "full availability of additional spectrum allocated or identified by [the Commission] has been delayed because the spectrum remains encumbered by legacy users").

[176] Qualcomm Comments at 4-5; *see also id.* at 2 (stating that "public safety entities have not yet been able to use the 24 MHz in the 700 MHz band because the DTV transition has not yet been completed"); Ericsson Comments at 6-7 (reporting that "any additional spectrum in [the 700 MHz] band would be unavailable until the [DTV] transition is complete").

[177] Maranatha Comments at 3.

[178] Unvision Comments at 3-4.

[179] *See id*.

[180] At this writing, a conference committee has established February 17, 2009, as the date for the completion of the transition from analog to digital broadcast transmissions. *See* H.R. Rep. No. 109-___, 109th Cong., 1st Sess. 3 (2005).

broadcast signal.[181]

3. Critical Infrastructure and Other Emergency Response Providers

61. As a preliminary matter, we note that a number of commenters urge a broad interpretation of the definition of "emergency response providers." As addressed below, these commenters contend that the term "emergency response provider" should include entities that maintain the nation's CI in emergencies, and government entities that coordinate emergency communications needs and operations at the local level.

62. First, UTC reports that CI entities are part of the emergency response community and should be included in the Commission's spectrum needs study.[182] UTC submits that CI entities have no spectrum allocated exclusively for their use, the shared bands currently in use are degrading, and these entities need a flexible spectrum allocation that would permit voice and data applications.[183] Further, UTC asserts that the spectrum needs of CI entities will increase with the growth of infrastructure and homeland security responsibilities, and explains that CI entities face new state regulatory requirements for responding to power outages that "will increase [the CI entities'] dependence on private wireless systems."[184]

63. Likewise, the National Association of Manufacturers (NAM) and MRFAC, Inc. (MRFAC), a frequency coordinator for the 30-900 MHz bands, jointly contend that emergency response providers should include organizations in addition to those that traditionally serve public safety roles.[185] NAM-MRFAC argue that failure to include manufacturers and industrial entities, which serve as emergency response providers pursuant to mutual aid agreements with communities, would "preclude the ability to extend mutual aid agreements to [additionally allocated] frequencies," thus hindering the assistance that manufacturers provide.[186] Motorola explains that, though the Commission's primary focus "is appropriately placed on state and local emergency responders," the Commission "should also consider the needs of critical infrastructure providers and non-governmental critical infrastructure personnel who respond in emergency situations to provide a more holistic understanding of spectrum needs."[187] Similarly, Lucent submits that governmental responsibility must include "all response personnel . . . including law enforcement, military, emergency response, health care, public works, and environmental communities."[188]

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[181] *See* 47 U.S.C. § 309(j)(14).

[182] *See* UTC Comments at 3.

[183] *See id.* at 9.

[184] *Id*. at 10.

[185] *See* NAM-MRFAC Comments at 3.

[186] *See id*. at 3, 6 (citing examples of companies that coordinate with emergency response providers to design customized service capabilities).

[187] Motorola Comments at 3. We note that Motorola also filed an *ex parte* presentation regarding public safety communications requirements, including the use of the spectrum allocated for public safety in the 700 MHz band. *See* Letter from Steve B. Sharkey, Motorola, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 05-157 (Oct. 27, 2005) (Motorola Oct. 27, 2005 *Ex Parte*).

[188] Lucent Comments at 7-8. We note that Lucent also filed an *ex parte* presentation regarding improving efficiency and capabilities, and promoting competition for emergency response providers. *See* Letter from Michael T. McMenamin, Lucent Technologies, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 05-157 (Nov. 10, 2005) (Lucent Nov. 10, 2005 *Ex Parte*).

64. In addition, Owens asserts that the scope of the term "emergency response provider" has expanded beyond inclusion of law enforcement, emergency medical services, fire and emergency management agencies, and that the term should now include "'part-time' emergency response providers, such as school administrators, infrastructure providers and Citizen Corps."[189] In discussing the proposed nationwide interoperable broadband mobile communications network, Speights asserts that a broad base of emergency response providers must have access to the network, including critical infrastructure entities.[190] Finally, the American Ambulance Association (American Ambulance) contends that government and non-government emergency medical services, including ambulance service providers, must have access to spectrum allocations designated for public safety use.[191]

4. Comments Favoring An Additional Allocation of Spectrum in the 700 MHz Band in Light of the Short-Term and Long-Term Needs of Federal, State and Local Emergency Response Providers

65. Public safety commenters at all levels - federal, state, local and regional - contend that, even considering the actions the Commission has taken to date, a need for allocations of additional public safety spectrum in the 700 MHz band remains. Likewise, critical infrastructure and other entities also indicate a need for allocations of additional public safety spectrum in the 700 MHz band.

66. Citing the increased demands on emergency response providers, commenters favoring additional public safety spectrum recommend that Congress grant an additional ten to thirty megahertz (in addition to the current twenty-four megahertz public safety allocation) in the 700 MHz band. First, the Los Angeles County Sheriff's Department (L.A. Sheriff) contends that Congress should allocate an additional ten megahertz of spectrum in the 700 MHz band to public safety entities.[192] L.A. Sheriff asserts that the additional allocation would "be used to relieve congestion on existing systems and to address a pressing need for a new, county-wide, broadband mobile communications system."[193] In addition, NYC supports an allocation of an additional ten megahertz in the 700 MHz band.[194] Northrop Grumman Information Technology, TASC, Inc. (Northrop Grumman IT) also recommends an additional allocation of at least ten megahertz in the 700 MHz band, asserting that the forthcoming twenty-four megahertz of spectrum "fails to facilitate use of today's wireless broadband technologies and applications."[195] The company proposes that an additional allocation of spectrum in the 700 MHz band would facilitate development of a nationwide broadband mobile network supporting interoperability and advanced applications,[196] and notes, "[a]t a minimum, broadband applications require ten megahertz of contiguous spectrum."[197]

67. Lucent estimates that an allocation of an additional ten to fifteen megahertz of spectrum in the 700 MHz band would support a nationwide interoperable mobile broadband network.[198] In

[189] Owens Comments at 1.

[190] *See* Speights Comments at 5.

[191] *See* American Ambulance Comments at 1-2.

[192] *See* L.A. Sheriff Comments at 6-7.

[193] *Id*. at 6.

[194] *See* NYC Comments at 11.

[195] Northrop Grumman IT Comments at 7.

[196] *See id.* at 7.

[197] *Id*. at 10.

[198] *See* Lucent Comments at 25.

addition, ARRC suggests that allocation of an additional twelve to twenty-four megahertz of spectrum in the Upper 700 MHz band "would be desirable to make the current 700 MHz allocation and the current 800 MHz bands contiguous and eliminate the problems associated with the proximity of commercial providers."[199] IPWireless, Inc. (IPWireless), a mobile broadband technology developer, reports that the current twenty-four megahertz allocation in the 700 MHz band does not "meet even current public safety needs."[200] The company therefore urges the Commission to "recommend to Congress an additional allocation from the 700 MHz UHF band of at least twenty megahertz of contiguous spectrum, or alternatively, two paired ten megahertz blocks suitable for frequency division duplex (FDD) use."[201]

68. FPIC contends that, regardless of the Commission's actions to date, a need for allocations of additional public safety spectrum remains. Specifically, FPIC submits that additional spectrum in the 700 MHz band would "meet a need for never before deployed interoperability among users on every side of the emergency response core groups."[202] FPIC contends that this approach would permit federal, state and local emergency response providers to enjoy "full, core, data communications interoperability."[203] FPIC recommends that Congress provide "an additional 30 MHz of public safety spectrum within the Upper 700 MHz band."[204] Given this recommendation, FPIC further proposes that the Commission recommend to Congress the cancellation of Auction No. 31.[205] FPIC states that this spectrum should be a "shared, primary government/non-government public safety allocation suitable for Federal, State, and local interoperable wideband data requirements."[206]

69. Similarly, Penn. Public Safety urges Congress to provide an additional allocation of spectrum in the 700 MHz band for emergency provider communications, and indicates its opposition to auctioning the remaining thirty-six megahertz of spectrum in the Upper 700 MHz band.[207] Further, Penn. Public Safety proposes dividing this thirty-six megahertz of spectrum as follows: (1) ten megahertz for state and local internal operations, (2) fifteen megahertz for critical infrastructure agencies for internal operations, (3) five megahertz for state licensees, and (4) six megahertz for federal homeland security

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[199] ARRC Comments at 2.

[200] IPWireless Comments at 2.

[201] *Id*.

[202] FPIC Comments at 5.

[203] *Id*.

[204] FPIC Comments at 4.

[205] *Id*. Auction No. 31 will offer thirty megahertz of spectrum in the 747-762 and 777-792 MHz bands. Auction No. 31 had been scheduled to begin on June 19, 2002, and the Commission had established auction procedures and received auction applications before the auction was postponed, "to provide additional time for Congress to consider legislation affecting the timing of that auction and, accordingly bidder preparation and planning." Auction of Licenses in the 747-762 and 777-792 MHz Band (Auction No. 31) Postponed Until January 14, 2003; Auction of Licenses in the 698-746 MHz Band (Auction No. 44) Will Proceed As Scheduled, *Public Notice*, 17 FCC Rcd 10108 (2002). With the enactment of the Auction Reform Act on June 19, 2002, Congress prohibited the commencement or conduct of Auction Nos. 31 and 44 on June 19, 2002. Auction Reform Act at § 3(a) (to be codified at 47 U.S.C. § 309(j)(15)(B)). The Commission has not rescheduled Auction No. 31. We also note that Section 337(a)(2) of the Communications Act provides that the Commission "shall allocate" thirty-six megahertz of spectrum in the Upper 700 MHz band for "commercial use to be assigned by competitive bidding." 47 U.S.C. § 337(a)(2). The 747-762 and 777-792 MHz band segments are part of the thirty-six megahertz of spectrum that the Commission reallocated for commercial use pursuant to Section 337(a)(2).

[206] FPIC Comments at 4.

[207] Penn. Public Safety Comments at 2.

agencies' internal operations.[208] Public safety consultant Speights urges Congress to reallocate the unauctioned portion of the Upper 700 MHz band, contending that this band "is more valuable . . . as a federal/state/local public safety interoperability band than as a commercial radio service band or for any other use."[209]

70. In addition, the Spectrum Coalition urges Congress to allocate additional spectrum for public safety in the 700 MHz band, because the band represents "the last spectrum with the desired propagation properties yet broad enough to support required data speeds."[210] The group concludes that Congress should consider "up to the entire thirty megahertz upper 700 MHz block" for allocation to federal, state and local public safety entities.[211] The Spectrum Coalition adds that additional spectrum, particularly in the 700 MHz band, is necessary to implement broadband capabilities and increase interoperability, both of which are critical to public safety.[212] NEMA submits that additional spectrum should allocated in the 700 MHz band, adjacent to the current public safety band, in order to preserve recent investments in equipment that operates in both the 700 MHz and 800 MHz bands.[213] Finally, the FRC asserts that the Commission must make additional spectrum available soon, and states that the current spectrum allocated for public safety use is inadequate for use with next generation technologies.[214]

71. Certain commenters urge Congress to grant additional allocations of spectrum in the 700 MHz Band, but do not specify an amount. For instance, the National Public Safety Telecommunications Council (NPSTC), a federation of associations representing various law enforcement and emergency agency organizations, and the Association of Public-Safety Communications Officials-International, Inc. (APCO), a frequency coordinator and trade association that represents police, fire, emergency medical and other public safety agencies, jointly assert the need for additional allocations of spectrum in the 700 MHz band given the new and expanded tasks after 9/11.[215] NPSTC-APCO state that public safety entities need additional spectrum in the 700 MHz band for mobile broadband capability, including wideband data and video.[216] In a recent *ex parte* filing, NPSTC emphasizes the importance "that additional spectrum be allocated for public safety services, particularly for meeting expanding mobile broadband demands below 1 GHz. The current 700 MHz allocation, no matter what its structure, is not adequate to meet these requirements."[217]

72. With respect to statewide entities, the CHP also supports allocation of additional spectrum in the 700 MHz band given its interest in enhancing its video downlink.[218] Delaware asserts

[208] *See id.* at 5.

[209] Speights Comments at 4.

[210] Spectrum Coalition Comments at 6. *See also* Spectrum Coalition White Paper at 4 ("It is then recommended that 30 megahertz of additional spectrum, comprising the C and D blocks in the upper 700 MHz band, be permanently reserved and allocated for share use of local, regional and federal public safety use").

[211] Spectrum Coalition Comments at 15-16.

[212] *See* Spectrum Coalition Comments at 2-3, 6.

[213] NEMA Comments at 2.

[214] FRC Comments at 2.

[215] *See* NPSTC-APCO Comments at 4-5.

[216] *See id.* at 5-8.

[217] Letter from Vincent R. Stile, NPSTC, to Michael J. Wilhelm, FCC, WT Docket No. 05-157 at 1 (Nov. 18, 2005) (NPSTC November *Ex Parte* Letter).

[218] *See* CHP Comments at 1.

that "[n]ew technologies in public safety will demand additional spectrum for LMR [Land Mobile Radio] and other communications applications,"[219] and adds that it has predicated communications planning "upon the availability of new LMR spectrum in both the 700 and 800 MHz bands."[220] In addition, the Florida DOT asserts, "the 700 MHz band represents [the] best opportunity for an advanced, statewide system of communications supporting the safety of the motoring public."[221] MDIT submits that its statewide system is experiencing significant growth,[222] and urges the Commission to consider the urgent need for access to spectrum in the 700 MHz band.[223] NYOT-SWN indicates its interest in deploying wideband data requirements through "50/100/150 kHz channel width allocations in a portion of the additional 700 MHz spectrum."[224] Penn. Public Safety states that the 700 MHz band provides a "means by which the public safety system's use can be expanded to local governments (*i.e.*, counties and townships), and is particularly suited to a statewide system like that of [Pennsylvania],"[225] and asserts that the 700 MHz spectrum will ensure "a truly *statewide* system."[226]

73. With respect to local entities, Grundy County reports that, in order to best serve emergency response providers, broadband applications require full motion driving speed capability, and mobility that would allow ubiquitous coverage over a wide area, and recommends allocation of an additional twenty megahertz of spectrum in the 700 MHz band to meet these requirements.[227] NY Westchester County stresses its immediate need for spectrum in the 700 MHz band and that the county "and similar communities . . . cannot wait for a years-long regulatory process."[228] Likewise, Los Angeles County (L.A. County) contends that the already allotted twenty-four megahertz in the 700 MHz band will not address the need for high speed data broadband mobile communications, because that allocation is "for narrowband voice and 'wideband' (150 kHz channel) data."[229] In its filing, L.A. Sheriff describes the need for more 700 MHz spectrum "for a new, county-wide . . . system [that can] transmit and receive high speed data and real time video images."[230] The Milwaukee PD requests "additional spectrum in the 700 MHz band for wideband operation. A common spectrum for voice, data, and wideband services offers the potential for a common radio platform."[231]

74. NYC contends that "the implementation of urgently needed new generation anti-crime and anti-terrorism initiatives immediately requires an allocation of, and supplementary means for public

[219] Delaware Comments at 1.

[220] *Id*. at 2.

[221] Florida DOT Comments at 6.

[222] *See* MDIT Comments at 2 (reporting that "[f]inding additional available frequencies within the NPSPAC band (821-823/866-869 MHz) is becoming a significant problem, especially in the Canadian border areas").

[223] *See id*.

[224] NYOT-SWN Comments at 5.

[225] Penn. Public Safety Comments at 4.

[226] *Id*. (emphasis in original).

[227] *See* Grundy County Comments at 1.

[228] NY Westchester County Comments at 8.

[229] L.A. County Comments at 3-4; *see also* Grundy County Comments at 1.

[230] L.A. Sheriff Comments at 6; *see also id.* at 3-4 (explaining the advantages of the 2.7 to 3.4 GHz and 3.4 to 3.7 GHz bands for airborne video downlink).

[231] Milwaukee PD Comments at 1.

safety to acquire suitable spectrum."[232] NYC explains its current consideration of a citywide mobile wireless network that would potentially rely on mesh network-based, Wi-Fi and Wi-Max solutions, including "sharing" of wireless technologies.[233] In supporting the allocation of additional spectrum in the 700 MHz band, NYC explains that the city is "moving aggressively . . . to test and procure mobile broadband networks that will provide emergency responders in the field with access to [high-speed data capabilities]."[234]

75. Similarly, Seattle reports a need for "wireless networking which supports propagation through buildings, real time video, large file transfers, enhanced mission-specific (police, fire, utility) applications, special geographic (map-based) presentations, simplified user interfaces, and use of Voice over IP (VoIP) for interoperability and redundancy."[235] Moreover, Seattle suggests that the Commission should pursue rule modifications for reallocating spectrum in the commercial 700 MHz band for use by emergency response providers.[236] Seattle also states that dedicated spectrum can resolve existing problems concerning "use of standards-based technology (rather than proprietary ones), constant development of new wireless technologies and the need for multi-jurisdictional interoperability agreements."[237]

76. Three RPCs also report a need for allocations of additional spectrum. First, the Arizona Regional Review Committee (ARRC), an organization responsible for public safety spectrum planning in RPC 3, stresses that "[t]he international border communities have the same spectrum needs for voice, and data communications as those that serve any large population centers in the center portion of the U.S.A,"[238] but are "forced to work with about [two thirds] of the 800 MHz spectrum found in the heartland area of the country."[239] ARRC claims that "[t]his limited amount of spectrum has already proven to be inadequate and impedes the implementation of interoperable systems that are planned."[240] In addition, RPC 8 supports allocations of additional spectrum in the 700 MHz band given this spectrum's ability to provide the coverage "necessary to support wide-area mobile data applications."[241] RPC 12 states that its members' "spectrum needs will only increase over time"[242] and that this area has "opted for 700 MHz as a result of it being clean spectrum that [Region 12 entities] could use immediately, and the possibility of gaining additional spectrum in the future."[243]

77. In addition, Seybold emphasizes, "an additional spectrum allocation in the 700 MHz band

[232] NYC Comments at 9.

[233] *See id.* at 9-11.

[234] *Id*. at 9. NYC describes a number of uses for these broadband networks, including the ability to access maps, building layouts, federal and state anti-crime databases, full-motion video to and from emergency scenes, and biological, chemical, nuclear and radiological monitoring and control. *See id*.

[235] Seattle Comments at 1; s*ee also* FPIC Comments at 4-5.

[236] *See* Seattle Comments at 2.

[237] *Id*.

[238] ARRC Comments at 1.

[239] *Id.*

[240] *Id*.

[241] *See* RPC 8 Comments at 8.

[242] RPC 12 Comments at 2.

[243] *Id*.

is absolutely necessary and now is the time to act."[244] Similarly, Motorola asserts the need to allocate expeditiously spectrum dedicated for the provision of broadband services capable of transmitting data at high rates, including real time video, because "[n]o spectrum currently available fully satisfies [those] requirements."[245] Rosum Corporation (Rosum), a company that markets location positioning systems, contends that use of 700 MHz band spectrum "enables a more accurate, precisely timed positioning network that would support emergency services and homeland security operations."[246]

78. Finally, as referenced above, CI and other entities also indicate a need for allocations of additional public safety spectrum in the 700 MHz band. UTC submits that CI entities need a "spectrum home" given that CI industries have increased federal homeland security responsibilities (and a corresponding need to maintain high control over CI systems), as well as new state-imposed responsibilities pertaining to power and telecommunications outages.[247] In addition, UTC contends that because utility and public safety personnel work together during emergencies, they "share the need to expand the wireless infrastructure,"[248] and reports that "[a]s needs increase, better communications interoperability among the larger response community, including both voice and data applications, would solve many problems."[249] Similarly, NAM-MRFAC assert that the Commission should recognize the need for allocations of additional spectrum in the 700 MHz band for those manufacturers and industrial entities that provide first responder capability under mutual aid agreements.[250] Finally, Motorola asks the Commission to "update its information and analysis to reflect changed circumstances in technology and spectrum demand in the 700 MHz band."[251]

5. Comments Favoring Additional Allocations of Public Safety Spectrum in Bands Other Than the 700 MHz Band In Light of the Short-Term and Long-Term Needs of Federal, State and Local Emergency Response Providers

79. Certain commenters urge Congress to grant additional allocations of public safety spectrum in bands other than the 700 MHz band. For instance, commenter William J. Carter (Carter) contends that additional allocations of spectrum should not be limited to the 700 MHz or the 4.9 GHz bands, but should include the VHF, UHF and 800 MHz bands.[252] Similarly, Enterprise "urges the Commission to support all solutions and to identify approaches that might allow [Enterprise's] members access to additional VHF and UHF spectrum, including Federal Government spectrum, for the express purpose of providing efficient and cost-effective service to emergency responders and other public safety entities."[253]

80. Commenters also indicate short-term and long-term needs for allocations of additional

[244] Seybold Comments at 1.

[245] *See* Motorola Comments at 6.

[246] Rosum Comments at 2.

[247] *See* UTC Comments at 10-12.

[248] *Id*. at 9.

[249] *Id*.

[250] *See* NAM-MRFAC Comments at 3, 6.

[251] *See* Motorola Comments at 2-4.

[252] *See* Carter Comments at 1.

[253] Enterprise Comments at 8-9.

public safety spectrum in the VHF band, as well as the 900 MHz and 4.9 GHz bands. For instance, the State of Wisconsin asserts that the "largest shortfall in public safety spectrum in Wisconsin is in the VHF High Band."[254] Further, the International Association of Fire Chiefs, Inc. and the International Municipal Signal Association (IAFC-IMSA) express a "need for additional spectrum in the VHF frequency band."[255] In addition, IAFC-IMSA urge the Commission to "move forward with whatever sharing may be available in the 138-144 MHz band,"[256] and assert that the VHF band provides the most effective coverage to meet dispersed geographic needs, and "the cost effectiveness so crucial to the Fire Service, especially in rural areas and to volunteer fire departments."[257] Citing the fact that it has achieved statewide interoperability "almost exclusively within the … VHF High Band,"[258] Missouri SHP states that this band "is in need of structure to maximize the potential of this already allocated band."[259] Similarly, L.A. Sheriff requests that the Commission "allocate at least [forty megahertz], primarily in the 3.4 GHz to 3.7 GHz band, or, in the alternative, in the 2.7 GHz to 3.4 GHz band, to public safety agencies . . . for tactical airborne video."[260] L.A. Sheriff asserts that this allocation, which would require six to eight megahertz of spectrum, would provide sufficient coverage capability for major emergency events and satisfactory interference protection.[261] In addition, Milwaukee PD reports a need for short range, small area communications capability, adding that this need may be met through allocations of spectrum in the 4.9 GHz band.[262]

81. NPSTC-APCO jointly assert the need for public safety access to additional spectrum in the 900 MHz band.[263] Specifically, NPSTC-APCO recommend that the Commission make the Business, Industrial and Land Transportation (B/ILT) pools in the 896-901/935-940 MHz (900 MHz) bands available to public safety agencies to use for paging systems.[264] According to NPSTC-APCO, public safety agencies are "exploring the option of digital one, and two way paging to support dispatch operations" because digital paging systems that incorporate computer-based, automated dispatching capabilities increase the timeliness and accuracy of dispatch functions.[265] Separately, Milwaukee PD contends that public safety entities require short range, small area communications capabilities that "may best be addressed through" allocations of spectrum in the 4.9 GHz band.[266]

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[254] Wisconsin Comments at 1.

[255] IAFC-IMSA Comments at 3.

[256] *Id*. at 4.

[257] *Id*. at 3.

[258] Missouri SHP Comments at 2.

[259] *Id*. at 5.

[260] L.A. Sheriff Comments at 1.

[261] *See id.* at 3-4.

[262] Milwaukee PD Comments at 1. The department also supports an expansion of the 700 MHz allocation for broadband wide-area services and requests maintaining without modification the fifty megahertz located in the 4.9 GHz band. *See id*.

[263] *See* NPSTC-APCO Comments at 8.

[264] *See id.* We note that the Commission is currently seeking comment on flexible use of certain portions of this spectrum. *See* Amendment of Part 90 of the Commission's Rules to Provide for Flexible Use of the 896-901 MHz and the 930-945 MHz Bands Allotted to the Business and Industrial Land Transportation Pool, *Notice of Proposed Rulemaking and Memorandum Opinion and Order*, WT Docket 05-62, 20 FCC Rcd 3814 (2005).

[265] *See id.*

[266] Milwaukee PD Comments at 1.

82. Finally, American Ambulance seeks allocations of additional spectrum to satisfy the requirements of Emergency Medical Services (EMS) providers; however, the association does not indicate a band preference. American Ambulance explains that, "[d]espite the spectrum documented by the [Commission], across the nation currently only two frequencies are dedicated to EMS (a local EMS frequency and a national EMS frequency)."[267]

6. Comments Favoring Efficient Use of Existing Public Safety Spectrum and Opposing An Additional Allocation of Public Safety Spectrum in the 700 MHz Band

83. A number of commenters assert that public safety entities have a duty to use spectrum more efficiently rather than to seek allocations of additional spectrum. As discussed below, these entities explain that emergency response providers must demonstrate spectral efficiency prior to seeking allocations of additional spectrum in the 700 MHz band.

84. With respect to wireless entities, CTIA first states that "because of the difficulties of gaining access to newly available spectrum, new wireless communications capabilities are more often provided through increased efficient use of existing spectrum by deploying technological enhancements, rather than through access to additional spectrum."[268] CTIA submits that "cellular and PCS providers have been able to obtain extensive gains in urban markets through use of small 'pico cells' that more rigorously reuse the same spectrum."[269] Moreover, states CTIA, "[b]y creating more consolidated (*e.g.*, state or regional) systems, emergency response providers could receive the same wireless capabilities while utilizing less spectrum."[270] CTIA contends that such systems also "offer greatly enhanced interoperability."[271] Similarly, T-Mobile "recognizes the need for government and industry to make optimal use of spectrum resources in order to promote Homeland Security,"[272] and urges the Commission to "encourage development of new efficient technologies."[273] In addition, in their paper, Access Spectrum and Pegasus argue that adoption of their proposals would protect public safety from interference, enable broadband deployment for public safety, commercial, and mixed-use operations, and improve the spectrum efficiency of the Upper 700 MHz band.[274]

85. MSV recommends that the Commission move toward a model of flexible allocations of spectrum, rather than applying a traditional policy of designating particular spectrum for limited purposes.[275] MSV argues that Congress' focus on the 700 MHz band incorrectly assumes the soundness

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[267] American Ambulance Comments at 1.

[268] CTIA Comments at 2.

[269] *Id*. A pico cell is a wireless base station with extremely low output power designed to cover an extremely small area, such as one floor of an office building. *See* NEWTON'S TELECOM DICTIONARY 636 (20th ed. 2004).

[270] CTIA Comments at 3.

[271] *Id*. at 3-4 (describing statewide networks in Pennsylvania, Michigan and Colorado as efficiently achieving interoperability, capacity and voice quality).

[272] T-Mobile Comments at 2.

[273] *Id*. at 3.

[274] *Id*. at 3.

[275] *See* MSV Comments at 19-21. We note that MSV also filed two white papers in the instant docket. *See* Letter from Jennifer A. Manner, Mobile Satellite Ventures LP, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 05-157 (Nov. 10, 2005) (appending *Toward a Next Generation Strategy: Learning from Katrina and Taking Advantage of New Technologies*); Letter from Jennifer A. Manner, Mobile Satellite Ventures LP, to Marlene H. Dortch, (continued….)

of its policy to provide specialized public safety spectrum, and that the digital transition will be completed expeditiously.[276] MSV urges "the Commission to think more broadly about what it means to make more spectrum available for public safety uses,"[277] and asks the Commission to "increase opportunities for technologically innovative and economically efficient spectrum use."[278]

86. Similarly, manufacturers and vendors generally assert that public safety entities must use spectrum more efficiently. First, smart antenna technology vendor ArrayComm asserts that an effort to improve spectrum efficiency should consider that spectrum "must be allocated and assigned as the result of plans developed by the appropriate public safety community."[279] In addition, Ericsson suggests, "public safety use of existing spectrum should be investigated in more depth before Congress considers allocating additional spectrum."[280] ITIC contends that "providing the public safety community with the funds it needs to most efficiently utilize its currently allocated bandwidth – rather than additional spectrum – would be the most effective use of the cleared 700 MHz band."[281] M/A-COM reports, "it would be premature for the Commission to allocate additional 700 MHz spectrum at this time, given the possibility of more timely access to, and efficient use of, existing allocations and the uncertain need for nationwide interoperable broadband networks."[282]

87. Likewise, Ericsson explains that "technological innovations have created networks today that are 76 times more efficient than those used just ten years ago . . . . [T]he use of . . . advanced technologies will decrease the amount of spectrum needed for public safety communication, even as the function of public safety entities expand."[283] Similarly, Qualcomm states that "Congress and the [Commission] should not reallocate any additional 700 MHz spectrum for public safety over and above" [284] the twenty-four megahertz allocated. Qualcomm explains that the RPCs have already undertaken "an exhaustive planning process" for use of this spectrum and have submitted plans to the Commission that have been available for public comment.[285] Given that public safety entities are not yet able to use the twenty-four megahertz in the 700 MHz band nationwide due to the ongoing digital television transition, Qualcomm argues that "[t]here is . . . no basis for the Commission or Congress to conclude . . . that public safety needs additional spectrum at all, much less in the 700 MHz band."[286]

88. Broadcaster Maranatha contends that the Commission "should recommend policies reflecting a realistic balance between the needs of emergency response agencies – which cannot be met, in the short term in the Upper 700 MHz band – and the vital service currently provided by television

(Continued from previous page)
Secretary, FCC, WT Docket No. 05-157 (June 22, 2005) (appending *Taking a Fresh Look at Public Safety's Spectrum Needs: Toward a Next- Generation Strategy for Public Safety Communications*).

[276] *See* MSV Comments at 19.

[277] *Id*.

[278] *Id*. at 21.

[279] ArrayComm Comments at 7.

[280] Ericsson Comments at 11.

[281] *See* ITIC Comments at 14.

[282] M/A-COM Comments at 9.

[283] *Id*. at 8-9.

[284] Qualcomm Comments at 2.

[285] *See id.*

[286] *Id*.

stations."[287] Maranatha asserts that local and state public safety agencies are subject to "long-term planning horizons . . . for study, design, funding and construction, and testing," and that "construction of new public safety networks in the Upper 700 MHz band in any 'short-term' time frame is a physical impossibility."[288] Similarly, Univision argues that Congress must address inadequate funding and the lack of coordination among emergency response providers as more immediate obstacles than additional spectrum availability.[289] Univision argues that, "merely allocating additional spectrum without addressing these threshold problems fails to advance the goal of interoperability, while threatening current broadcast service to the public – a result that is, at best, inefficient use of that spectrum, and at worst, detrimental to public safety."[290]

89. The PFF asserts that "[g]iven the large amount of spectrum already allocated to public safety agencies and its high opportunity cost, an extra dollar spent on other inputs, including new equipment and additional public safety personnel, is likely to yield far more in terms of improving the emergency response effort than an extra dollar's worth of spectrum."[291] Moreover, PFF contends that "[e]mergency response providers have neither the ability nor the incentive to use their spectrum efficiently."[292] PFF argues that "[g]iving public safety licensees expanded property rights in the licenses they already hold" would permit flexible use and resale, and would "be far more valuable" than granting more spectrum.[293]

90. Finally, Professor Jon M. Peha (Peha), Associate Director, Center for Wireless and Broadband Networks, Carnegie Mellon University, submits that the Commission should allow "public agencies to share spectrum with other kinds of wireless systems, including those used to offer commercial services."[294] Peha further asserts that although public safety must have adequate spectrum during emergencies, these entities have modest needs generally.[295] Thus, Peha argues, "[a]n appropriate sharing mechanism, that gives priority to public safety when needed, could be beneficial to all."[296]

7. Findings

91. Prior to undertaking the instant study, the Commission has endeavored to provide adequate spectrum to meet public safety's spectrum needs and has taken a number of recent actions in connection with this goal. In 2003, the Commission took action to bring about timely implementation of narrowband technologies in Private Land Mobile Radio (PLMR) frequencies dedicated to public safety in the 150-174 MHz and 421-512 MHz bands by adopting a transition schedule, [297] which it modified

[287] Maranatha Comments at 4.

[288] *Id*. at 3.

[289] *See* Univision Comments at 6.

[290] *Id*.

[291] PFF Comments at 3.

[292] *Id*. at 4.

[293] *Id*.

[294] Peha Comments at 3.

[295] *See id.*

[296] *Id*.

[297] *See* Implementation of Sections 309(j) and 337 of the Communications Act of 1934 as Amended, *Second Report and Order and Further Notice of Proposed Rulemaking*, WT Docket No. 99-87, 18 FCC Rcd 3034 (2003).

slightly in 2004 at the request of public safety and other entities.[298] Earlier this year, the Commission specified procedures by which forty PLMR channels, located in frequency bands allocated primarily for federal government use, are to transition to narrower, more spectrally efficient channels.[299] Specifically, given the NTIA deadlines by which Federal operations in the 150.05-150.8 MHz, the 162.0125-173.2 MHz and 173.4-174 MHz (162-174 MHz),[300] and the 406.1-420 MHz bands (collectively, the Federal bands) must transition to 12.5 kHz (narrowband) channels,[301] the Commission developed a transition plan to accommodate the shared Federal and non-Federal Government (non-Federal) use of these bands, and proposed specific narrowbanding procedures for these bands. Among other things, this action will promote efficient spectrum use and help accommodate any additional demand for spectrum.

92. In 2004, the Commission acted to reconfigure the 800 MHz band and created access to an average of 4.5 megahertz of additional spectrum in that band for use by public safety licensees.[302] In taking this action, the Commission first defined unacceptable interference in the 800 MHz band and implemented procedures detailing responsibility for abating this interference, and, for the long-term, the Commission reconfigured the 800 MHz band to address the cause of the interference by separating generally incompatible technologies. The cost of rebanding is being borne by Sprint Nextel, a commercial operator in the band, rather than by the licensees of the stations that must be relocated (changed in operating frequency) to implement band reconfiguration. In addition to the cost of retuning or, in some instances, replacing, equipment, Sprint Nextel pays the relocating licensees' for reasonable associated administrative and transactional expenses. Actions to improve public safety access to spectrum in the 800 MHz band are described and depicted in Appendix E.

93. In addition, the Commission acted to promote interoperability among emergency response providers in the New York City area by permanently reallocating a portion of television spectrum for their use.[303] The Commission recognized the critical need to avoid jeopardizing the reliability of the area's telecommunications system in times of crisis[304] and reserved television Channel

[298] *See* Implementation of Sections 309(j) and 337 of the Communications Act of 1934 as Amended, *Third Memorandum Opinion and Order, Third Further Notice of Proposed Rulemaking and Order*, WT Docket No. 99-87, 19 FCC Rcd 25045 (2004).

[299] *See* Amendment of Parts 2 and 90 of the Commission's Rules to Provide for Narrowband Private Land Mobile Radio Channels in the 150.05-150.8 MHz, 162-174 MHz, and 406.1-420 MHz Bands that are Allocated for Federal Government Use, *Report and Order*, 20 FCC Rcd 5793 (2005) (*Narrowbanding Report and Order*).

[300] We use the term "162-174 MHz band" for convenience and do not intend to suggest that we are modifying herein the Commission's narrowbanding procedures for the 173.2-173.4 MHz band, which is allocated for exclusive non-Federal use.

[301] The Commission, an independent agency, administers spectrum allocated for non-Federal use and the NTIA, an operating unit of the Department of Commerce, administers spectrum allocated for Federal use. *See* 47 C.F.R. § 2.105(a). NTIA approves the spectrum needs of new systems for use by Federal departments and agencies and maintains the Federal Government Table of Frequency Allocations (Federal Government Table) in its *Manual of Regulations & Procedures for Federal Radio Frequency Management*, May 2003 Edition including the September 2004 Revision. Specifically, Federal operations in the 162-174 MHz band have been required to be narrowbanded since January 1, 2005 and Federal operations in the 150.05-150.8 MHz and 406.1-420 MHz bands must be narrowbanded by January 1, 2008.

[302] *See* Improving Public Safety Communications in the 800 MHz Band, *Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order*, WT Docket No. 02-55, 19 FCC Rcd 19651 (2004).

[303] *See* Amendment of Parts 2, 73, 74 and 90 of the Commission's Rules to Permit New York City Metropolitan Area Public Safety Agencies to Use Frequencies at 482-488 MHz, *Report and Order*, ET Docket Nos. 03-158 and 03-159, 19 FCC Rcd 6719 (2004).

[304] *See id.* at 6721 ¶ 6.

16 to facilitate effective public safety communications while allowing the affected agencies to devise long-term plans.[305] Indeed, in its comments in the instant proceeding, NYC explains that the Commission's action "has had significant benefits [and] provides interoperable communications at the onset of an incident."[306] Pursuant to the authority granted by Section 337 of the Communications Act, the Bureau also granted requests from nine public safety entities in the area to use "unassigned" spectrum not otherwise allocated for public safety use.[307]

94. In 2003, the Bureau permitted the shared use of VHF federal and non-federal spectrum by the state of Alaska and the federal government.[308] This action allowed the construction of the first system specifically dedicated for shared public safety operations by federal, state, and local public safety entities statewide.[309] The Bureau concluded that this Alaska Land Mobile Radio (ALMR) system would facilitate attaining spectrum efficiency and interoperability.[310]

95. The 4.9 GHz band was transferred from Federal Government to non-Government use in 1999, in accordance with the provisions of the Omnibus Budget Reconciliation Act. In 2000, the Commission issued an NPRM that did not contemplate public safety use of the band. However, subsequently, numerous state, county, local government and national public safety associations persuasively argued that a public safety designation would enable responders to carry out critical and urgent missions more effectively, and would provide a safer environment for emergency responders. Accordingly, in 2002, the Commission allocated the entirety of the transferred fifty megahertz in the 4.9 GHz band for use in support of public safety.[311]

96. Regarding the use of commercial spectrum for public safety purposes, the Commission has worked with the NCS and participating telecommunications providers to establish a regulatory framework that would facilitate Wireless Priority Access Service (PAS) being accessible and available during times of national emergencies. Under the PAS rules, wireless carriers that have elected to provide wireless PAS allow authorized national security and emergency preparedness personnel to obtain access to the next available wireless channel to originate a call.

97. These initiatives evince the Commission's longstanding commitment to working with public safety to meet its immediate and short-term spectrum needs. The Commission will continue to address public safety's short-term spectrum needs through the Section 337 process and other proceedings, as necessary. The twenty-four megahertz of spectrum in the 700 MHz band should also help satisfy the need for additional public safety spectrum in the short term. The Commission has been supportive of accelerating completion of the DTV transition to the greatest extent possible, including, *e.g.*, the

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[305] *See id.* at 6728 ¶ 21.

[306] NYC Comments at 6. *Cf.* Penn. Public Safety Comments at 6 (noting that the allocation of Channel 16 for use by the City of New York only benefits a very limited geographic area).

[307] *See, e.g.*, Seven Public Safety Agencies in the New York Metropolitan Area, Proposal to Use Part 22 Paging Frequencies Pursuant to Section 337(c) of the Communications Act of 1934, as Amended, and Section 1.925 of the Commission's Rules to Operate Public Safety Communications Systems, *Order*, 19 FCC Rcd 15355 (WTB PSCID 2004).

[308] *See* State of Alaska, Request for Waiver of Sections 2.102(c), 2.103(a), 90.20, and 90.173(c) of the Commission's Rules, *Memorandum Opinion and Order*, 18 FCC Rcd 16315, 16315 ¶ 1 (WTB 2003).

[309] *See id.*

[310] *See id.* at 16331 ¶ 27.

[311] *See* The 4.9 GHz Band Transferred from Federal Government Use, *Second Report and Order and Further Notice of Proposed Rule Making*, WT Docket No. 00-32, 17 FCC Rcd 3955, 3956 ¶ 1 (2002).

requirement that most new television sets must have DTV reception capability.[312] We will continue to facilitate the ability of public safety to productively plan for the use of this spectrum by continuing to work with public safety and broadcasters to clear 700 MHz spectrum in as many geographic areas as possible during the transition period. Emergency response providers also should closely coordinate with broadcasters to clear 700 MHz spectrum in their respective regions. This would enable public safety entities to access the spectrum as quickly as possible, without degrading or disrupting broadcast service. Although the DTV transition is an important component to satisfying the short-term spectrum needs of emergency response providers, completion of the 800 MHz band reconfiguration process should also yield significant benefits to first responders in the short-term.

98. While the effort to address the short-term spectrum needs of public safety is underway, attaining a wholesale assessment of long-term spectrum needs is an ongoing task. Public safety commenters generally agree that emergency response providers need access to additional spectrum, but there is a lack of unanimity within the public safety community regarding how much spectrum will be needed. We expect that public safety's long-term needs will become clearer as existing public safety spectrum allocations in the 700 MHz, 800 MHz, and 4.9 GHz bands are fully deployed and initiatives to make more efficient use of existing spectrum are completed. This important question nevertheless deserves continued study and consideration. We will also continue to monitor projects undertaken or proposed by public safety entities and commercial service providers to enhance the capabilities of emergency response providers and to increase efficient use of spectrum within the public safety bands.[313]

99. As noted above, the Commission believes that mobile broadband communications could offer public safety many important capabilities, including delivery of real-time video, images, automated dispatch, multi-media alerts and real-time monitoring. Accordingly, accommodating public safety's need for mobile, broadband communications may be critical in the long-term. Certain public safety entities have identified the 700 MHz band as a potential home for broadband operations and have urged Congress to consider an additional allocation of spectrum for this purpose. The Commission agrees that public safety could make use of such an allocation in the long-term to provide broadband services. We also believe that spectrum is only one factor in ensuring that emergency response providers have access to mobile broadband applications. Public safety entities must also have access to adequate funding to upgrade or replace existing infrastructure and for associated training. Without adequate funding for such purposes, any additional public safety spectrum allocations may lay fallow, and existing allocations may be used inefficiently.

100. The public safety community has also recently asked the Commission to initiate a rulemaking to examine whether the wideband channels currently allocated for public safety use in the 700 MHz band could accommodate the use of broadband technologies. At the urging of public safety and in recognition of the need for spectrum appropriate for broadband communications, the Commission will expeditiously examine whether certain channels within the current allocation of twenty-four megahertz of public safety spectrum in the 700 MHz band could be modified to accommodate broadband communications.

IV. CONCLUSION

101. In response to Congress' inquiry pertaining to the study of spectrum needs of emergency response providers, this report reaches the following principal conclusions, as discussed above. First, as to the operation and administration of a potential nationwide interoperable broadband mobile

[312] *See* Review of the Commission's Rules and Policies Affecting the Conversion to Digital Television, *Second Report and Order and Second Memorandum Opinion and Order*, MM Docket 00-39, 17 FCC Rcd 15978 (2002).

[313] A discussion of projects to enhance capabilities of emergency response providers noted by commenters is set forth in Appendix D.

communications network based upon input from federal, state, local and regional emergency response providers, emergency response providers would benefit from the development of an integrated, interoperable nationwide network capable of delivering broadband services throughout the country. Second, as to the use of commercial wireless technologies, while commercial wireless technologies and services are not appropriate for every type of public safety communication, there may now be a place for commercial providers to assist public safety in securing and protecting the homeland. Finally, with respect to the short-term and long-term needs for allocations of additional portions of spectrum for federal, state and local emergency response providers, the Commission has undertaken a series of initiatives to free up additional public safety spectrum in the short term, and continues to evaluate public safety's spectrum needs in the long-term. To this end, and at the urging of public safety, the Commission will expeditiously examine and analyze whether certain channels within the current allocation of twenty-four megahertz of public safety spectrum in the 700 MHz band could be modified to accommodate broadband communications.

Appendix A
Parties Filing Comments
In Alphabetical Order By Stakeholder Group

Public Safety/Critical Infrastructure **(28)**

Name of Party	**Abbreviation**
American Ambulance Association	American Ambulance
Arizona Regional Review Committee	ARRC
California Highway Patrol	CHP
Captain Sonja L. Owens	Owens
City of New York	NYC
City of Seattle	Seattle
Commonwealth of Pennsylvania, Office of Public-Safety Radio Services	Penn. Public Safety
County of Los Angeles, Internal Services Department, and Sheriff's Department	L.A. County
Los Angeles County Sheriff's Department	L.A. Sheriff
FCC Region 8 700 and 800 MHz Regional Planning Committees	RPC 8
FCC Region 12 700 MHz Regional Planning Committee	RPC 12
Federal Partnership for Interoperable Communications	FPIC
First Response Coalition	FRC
Florida Department of Transportation	FDOT
Grundy County Emergency Telephone System Board (Morris, Illinois)	Grundy County

International Association of Fire Chiefs, Inc. and the International Municipal Signal Association	IAFC-IMSA
Michigan Department of Information Technology	MDIT
Milwaukee Police Department	Milwaukee PD
Missouri State Highway Patrol	Missouri SHP
National Public Safety Telecommunications Council (NPSTC), Association of Public-Safety Communications Officials-International, Inc. (APCO), International Association of Chiefs of Police, Major Chiefs Association, National Sheriff's Association and Major County Sheriff's Association	NPSTC-APCO
National Emergency Management Association	NEMA
National League of Cities	NLC
New York State Office of Technology - Statewide Wireless Network	NYOT-SWN
Spectrum Coalition for Public Safety	Spectrum Coalition
State of Delaware	Delaware
State of Wisconsin	Wisconsin
United Telecom Council	UTC
Westchester County, New York	NY Westchester County

Wireless Carriers and Associations **(4)**

Bizcom USA, Inc. d/b/a CX2Technologies	CX2
CTIA – The Wireless Association	CTIA
Enterprise Wireless Alliance	Enterprise
T-Mobile USA, Inc.	T-Mobile

Satellite Providers and Associations **(4)**

Iridium Satellite, LLC	Iridium
Mobile Satellite Ventures Subsidiary LLC	MSV

Satellite Industry Association	SIA
TerreStar Networks, Inc.	TerreStar
Broadcasters **(2)**	
Maranatha Broadcasting Company	Maranatha
Univision Communications, Inc.	Univision
Manufacturers/Vendors/Consultants **(16)**	
ArrayComm, Inc.	ArrayComm
Cisco Systems, Inc.	Cisco
Ericsson, Inc.	Ericsson
Information Technology Industry Council	ITIC
Interoperable Wireless	Interoperable Wireless
IPWireless, Inc.	IPWireless
Lucent Technologies, Inc.	Lucent
M/A-COM Corporation	M/A-COM
Motorola, Inc.	Motorola
National Association of Manufacturers and MRFAC, Inc.	NAM-MRFAC
Northrop Grumman Information Technology, TASC, Inc.	Northrop Grumman IT
PacketHop, Inc.	PacketHop
Qualcomm, Incorporated	Qualcomm
Rosum Corporation	Rosum
Speights Telecom, Inc.	Speights
Telecommunications Industry Association	TIA
Other Commenters **(6)**	
Andrew Seybold	Seybold

Andy Middlebrooks	Middlebrooks
Jon M. Peha	Peha
Management Communications Services	MCS
The Progress and Freedom Foundation	PFF
William J. Carter	Carter

Appendix B

Use of Commercial Wireless Technologies and Services

I. Introduction

Interoperability may have different meanings depending on the context. The public safety community generally understands the term to mean "the ability for public safety agencies and public services to talk to one another via radio communications systems and/or share information with one another accurately, on demand, in real time, when needed, and when authorized."[1] The Commission has defined "interoperability" as "[a]n essential communications link within public safety and public wireless communications systems which permits units from two or more different entities to interact with one another and to exchange information according to a prescribed method in order to achieve predictable results."[2] The Commission has previously considered the role of commercial wireless technologies and services[3] in satisfying the interoperability needs of public safety agencies.[4] Public safety agencies have historically been hesitant to replace private, dedicated systems[5] with systems that wholly or partially incorporate commercial technologies and services, particularly for mission critical communications, given the concern that commercial wireless systems typically did not meet public safety's unique communication needs or reliability requirements.[6]

The continuing evolution of wireless technologies may address or mitigate at least some of these concerns. While commercial wireless technologies may not be appropriate for every type of public safety communication, public safety agencies may find it useful to employ commercial wireless technologies for certain limited purposes to fulfill their role in protecting and securing the homeland. Public safety entities may also benefit from partnering with commercial wireless providers to leverage technological advances and enter into mutually beneficial network agreements, especially with respect to non-mission critical

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1 Research Brief, *We Need to Talk: Governance Models to Advance Communications Interoperability*, NASCIO at 1 (Nov. 2005) (NASCIO Research Brief) (https://www.nascio.org/nascioCommittees/interoperability/index.cfm#publications).

2 *See* Development of Operational, Technical, and Spectrum Requirements for Meeting Federal, State, and Local Public Safety Agency Communication Requirements Through the Year 2010, *First Report and Order*, WT Docket No. 96-86, 14 FCC Rcd 152 ¶ 76 (1998).

3 Commercial wireless services cover a variety of mobile and fixed communication options provided to the general public (*i.e.*, a wireless communications service generally offered to the general public for a subscriber fee). Some of the more familiar commercial services include cellular telephone, paging, satellite, Personal Communications Systems (PCS) and enhanced specialized mobile radio (ESMR) systems.

4 *See, e.g.*, Development of Operational, Technical, and Spectrum Requirements for Meeting Federal, State, and Local Public Safety Agency Communication Requirements Through the Year 2010, *Notice of Proposed Rulemaking*, WT Docket No. 96-86, 11 FCC Rcd 12460, 12484-12492 ¶¶ 72-90 (1996); Development of Operational, Technical, and Spectrum Requirements for Meeting Federal, State, and Local Public Safety Agency Communication Requirements Through the Year 2010, *Second Notice of Proposed Rulemaking*, WT Docket No. 96-86, 12 FCC Rcd 17706 (1997); Development of Operational, Technical, and Spectrum Requirements for Meeting Federal, State, and Local Public Safety Agency Communication Requirements Through the Year 2010, *First Report and Order*, WT Docket No. 96-86, 14 FCC Rcd 152 (1998).

5 These private internal radio systems are generally owned and operated by individual public safety agencies and are designed specifically to meet the needs of public safety personnel (*i.e.*, the systems are designed to cover the areas needed and in the necessary protocol for the public safety mission), while commercial wireless systems are designed to serve the general public or to accomplish personal or business communications.

6 *See, e.g.*, RPC 8 Comments at 9; NPSTC-APCO Comments at 9-11; RPC 12 Comments at 3; NEMA Comments at 2; Grundy County Comments at 1; Milwaukee PD Comments at 1.

duties.

While many public safety agencies may lack funding needed to access commercial wireless technologies,[7] there is a developing trend towards federal, state and local partnerships that provide public safety users affordable access to commercial wireless technologies.[8] Commercially proven, high-speed mobile data capabilities can enhance public safety capabilities in both a timely and cost-effective manner.[9] As to timeliness, public safety would benefit because technologies are already widely available in the commercial marketplace. Given this wide availability, public safety entities would also benefit from the associated economies of scale for purchasing, replacing and maintaining equipment and facilities.[10] Further, given that certain of these technologies employ non-proprietary standards, public safety entities would be in a better position to take advantage of technological upgrades more quickly.

Moreover, technological solutions are emerging that show significant promise for addressing interoperability. There are commercial wireless technologies currently or soon to be available to provide options for public safety entities at every level of the Department of Homeland Security (DHS) "interoperability continuum."[11] Interoperability is a multi-faceted concept that occurs across this continuum. The minimal end of the continuum reflects easily deployed solutions, such as exchanging radios and sharing mutual aid channels at the scene of an emergency. At the optimal end of the continuum, however, public safety would share a nationwide, uniform, standards-based system complete with interoperable radio handsets. Gateways, Wi-Fi and Wi-Max,[12] wireless mesh, and other bridging technologies, which offer more limited steps toward achieving interoperability when a shared interoperability system is not available, represent a middle ground. Commercial wireless technologies and services that facilitate interoperability, as well as mobile infrastructures, which support and enhance

[7] A number of commenters emphasize the significant cost that public safety agencies would incur to upgrade existing communications equipment and systems to achieve interoperability. For example, NYOT-SWN directly equates "the degree to which a wide area interoperable land mobile communications network could be implemented . . . to the funding available." NYOT-SWN Comments at 5. NY Westchester County notes that "the absence of adequate financial resources is . . . a threat to [interoperability] progress." NY Westchester County Comments at 9. The FRC similarly emphasizes the enormous financial shortfall emergency response providers will face over the next few years as they as they strive to achieve interoperability. FRC Comments at 6-7.

[8] *See e.g.*, Jim Barthold, *Lucent, Aloha Explore 700 MHz Muni Space*, P&F BROADBAND DAILY, Oct. 25, 2005 (describing a deal between Lucent and Aloha Partners to undertake a public safety trial using 700 MHz wireless technology in Arizona as "a demonstration of public-private cooperation").

[9] *See* Lucent Nov. 10, 2005 *Ex Parte* at 5.

[10] Thomas Coty of DHS recently remarked, "it is essential that funding be lined up to facilitate legacy system migration and/or interoperability development over time." Jeffrey Elliot, *State of Public Safety*, PUBLIC SAFETY REPORT, Oct. 2005 at 77 (Oct. 2005 Public Safety Report). Public safety consultant Craig Jorgensen similarly stated, "Congress and many other political leaders have failed to meet the critical needs of this nation's public safety community with regard to funding…. They fail to recognize that first responders and other public agencies throughout this country are operating on communications networks that are in many cases more than twenty years old." *Id*. at 72.

[11] *See* http://www.safecomprogram.gov/NR/rdonlyres/72E16B22-6928-4676-A82A-B6858E7974FA/0/InteroperabilityContinuum.pdf. *See also* OCTO Presentation at 2 (depicting the continuum of public safety wireless communications interoperability capabilities in the Washington, D.C. area).

[12] Wi-Fi and Wi-Max are acronyms for "wireless fidelity" and "Worldwide Interoperability for Microwave Access," respectively. We discuss these wireless technologies below.

interoperable communications, are discussed in turn below. [13]

II. Overview of Commercial Wireless Technologies and Services

Smart and cognitive radios. "Smart radios" and "cognitive radios" may benefit public safety agencies by helping to facilitate nationwide interoperable mobile communications.[14] Over the past several years, technologies have increased the computer processing capabilities of radio system technologies. As a result, radio system designs increasingly incorporate software, thereby making basic functions easier to implement and more flexible. As the capabilities have advanced, radio systems have been gaining increased abilities to be "cognitive" -- to adapt their behavior based on external factors. Cognitive radios are therefore currently capable of operating on multiple frequencies in multiple formats so that different systems can interconnect.[15]

The proper implementation of a public safety communications system with adequate spectrum and cognitive radios may help to ensure that both data and voice transmit among agencies instantly. For example, cognitive radios could incorporate various features, including frequency agility,[16] Dynamic Frequency Selection (DFS),[17] adaptive modulation,[18] Transmit Power Control (TPC),[19] and location awareness.[20] In addition, cognitive radios may include a negotiated use mechanism that permits the

[13] We note that a discussion of commercial satellite technologies and services is set forth in Appendix C.

[14] *See* Facilitating Opportunities for Flexible, Efficient, and Reliable Spectrum Use Employing Cognitive Radio Technologies, *Report and Order,* ET Docket 03-108, 20 FCC Rcd 5046 (2005) (*Cognitive Radio Report and Order*). While public safety agencies may continue to have reservations over the reliability and use of smart or cognitive radios, the continuing evolution of these technologies may obviate some of their concerns. For example, as we noted in *Cognitive Radio Report and Order*, the Software Defined Radio (SDR) Forum, an international nonprofit organization dedicated to promoting the development and use of smart and cognitive radios, has established a Special Interest Group for Public Safety to ensure the continued development of these technologies for use within the public safety sector. *See id.* at 5495 ¶28.

[15] Specifically, under the Commission's rules, "smart radios" or "software defined radios" include any "radio that includes a transmitter in which the operating parameters of frequency range, modulation type or maximum output power can be altered by making a change in software without making any changes to hardware components that affect the radio frequency emissions." 47 C.F.R. § 2.1. Whereas "smart radios" can be programmed to transmit and receive on any of a variety of frequencies and/or to use one or more different transmission formats supportable by their hardware design, "cognitive radios" empower the radios to alter their transmitter parameters based on interaction with the environment in which they operate. *See Cognitive Radio Report and Order,* 20 FCC Rcd at 5489 ¶¶ 9-10.

[16] *See id.* at 5490 ¶ 11 (explaining that frequency agility refers to the ability of the radio to change operating frequencies to optimize use under varying conditions).

[17] *See id.* (explaining that DFS allows the radio to sense signals from other nearby transmitters in an effort to choose an optimum operating environment).

[18] *See id.* (explaining that adaptive modulation refers to the radio's capability to modify transmission characteristics and waveforms to exploit opportunities to utilize spectrum).

[19] *See id.* (explaining that TPC permits transmission at full power limits when necessary and constrains transmitter power to a lower level to allow greater sharing of spectrum when higher power operation is unnecessary).

[20] Location awareness describes the radio's ability to determine location and the location of other transmitters in order to first determine whether conditions permit transmission and to then select appropriate operating parameters such as the power and frequency allowed at the location. *See id.*

sharing of spectrum under the terms of a prearranged agreement between a licensee and a third party.[21] Indeed, cognitive radios may eventually enable negotiation of spectrum use on an *ad hoc* or real-time basis, without the need for prior agreements between all parties.[22] These technical characteristics and advanced capabilities create the potential for cognitive radios to foster interoperability because the technology will allow radios to intelligently jump to different frequencies and formats, as needed, to establish communications, thereby offering emergency response providers with a more efficient and resilient communications network.[23]

Communications gateways. Communications gateways retransmit voice and data across multiple frequency bands and provide an interim interoperability solution as agencies move toward shared systems. The emergence of communication gateways offers the public safety community the potential for nationwide, interoperable mobile communications because a gateway will interconnect multiple frequency bands and links trunked talk groups, encrypted networks, cell phones, satellite phones, and the public switched telephone network. Moreover, a communications gateway may be implemented without significant radio infrastructure modifications, is relatively affordable and widely available. For example, Cisco Systems, Inc. (Cisco) reports its "Land Mobile Gateway" employs IP-based technology, based on 802.11 protocol, and operates on diverse frequencies to provide interoperable capability, which permits two or more public safety entities to agree to interoperate without the need for region-wide or state-wide protocols.[24]

One factor to consider, however, in implementing communications gateways is that they may not be spectrally efficient because the system itself uses spectrum channels in order to facilitate the interoperable communications. In addition, gateways lack a single control/signaling system, and have the potential to be insecure. Nevertheless, communications gateways, when implemented with care and a high level of coordination among agencies and jurisdictions, may provide the pubic safety community with a beneficial intermediate option for achieving interoperability.

IP-based technology. A robust interoperable network must be able to function in all areas served by emergency response providers, including areas where most of the communications infrastructure is degraded or non-existent. IP-based technology may enhance the resiliency of traditional public safety networks by providing the dynamic capability to change and reroute telecommunications voice and data traffic within the network. Moreover, IP-based systems may generally facilitate the ability of emergency response providers to communicate complex information between offices and the field. Greater incorporation of IP-based technology into public safety networks may allow public safety entities to restore service in the event of failure, as well as initiate coverage in new areas more rapidly. Many commenting parties report that IP technology may provide an integral part of a solution to the interoperability problem.[25] For example, the Wireless Accelerated Responder Network (WARN), operated by the Washington, D.C. Office of Chief Technology Officer (OCTO), is a citywide broadband wireless system that relies on IP-based technology to provide emergency response providers the ability to

[21] *See id.*

[22] *See id.*

[23] *See, e.g.*, Government Accountability Office, Protecting Structures and Improving Communications During Wildland Fires 61-62 (April 2005) (http://www.gao.gov/new.items/d05380.pdf).

[24] *See* Cisco Comments at 2-4.

[25] *See* Spectrum Coalition Comments at 5; PacketHop Comments at 3; Seattle Comments at 1; Lucent Comments at 4, 9-10; UTC Comments at 12; Seybold Comments at 2.

use video communications and other technologically advanced applications to enhance public safety.[26]

The concept behind IP interoperability is simple: public safety communications devices would contain an interface between the radio side of the instrument and an IP-based Internet side of the instrument. This would allow these devices to interoperate based strictly on Internet connectivity and the use of IP-based protocols for interconnection.[27] It is worth noting that companies are starting to roll out equipment that provides this interconnection.[28] We also note that a number of commercial companies are marketing devices that provide for the direct interconnection of radios via cross-connection.[29]

The full realization of the interoperability benefits of IP-based technology may require a substantial investment of both time and money. Public safety agencies may need to re-equip their existing communications networks with IP-compatible equipment and design an interoperable network architecture incorporating a gateway device in each radio network that provides the connectivity to the Internet or other IP-based Intranets. In addition, there is a question as to whether an Internet-based connectivity for public safety radios may introduce or increase the potential for issues of vulnerability and reliability.[30]

Wi-Fi and Wi-Max technologies. Wireless fidelity (known as Wi-Fi) generally refers to any type of wireless Local Area Network (LAN) employing an 802.11 standard.[31] Wireless LANs use high-

[26] *See* Motorola Comments at 7 n.13. According to FPIC, OCTO demonstrates "full, core data communications interoperability." *See* FPIC Comments at 5; *see also* Spectrum Coalition Comments at 12.

[27] Just as a computer network uses IP technology to facilitate communication between end users on the network regardless of whether the end users on the network are using Windows, Mac OS or the LINUX operating system, public safety communication devices using IP interconnectivity will reportedly be able to interoperate with other such equipped devices whether the radio side of the devices are operating on spectrum in the UHF/VHF, 700 MHz, 800 MHz, 4.9 GHz or satellite bands. *See* Cisco Comments at 2-4; Lucent Comments at 20-21.

[28] Cisco's Internet Protocol Interoperability and Collaboration Systems (IPICS) employs an IP-based solution consisting of a set of software programs and hardware interfaces that interconnect existing radio networks without requiring the replacement of existing equipment. *See* John Markoff, *A Cisco System to Make Radios Work Together*, N.Y. TIMES (Oct. 24, 2005).

[29] Because this technology is network-based and not reliant on frequency availability, an IP-based solution accomplishes cross-banding among disparate radios, thereby allowing, for example, VHF radios to talk to 800-MHz radios. The Raytheon Corporation offers the AMU-1000 to provide direct cross banding for public safety radio systems. *See* http://www.jps.com/index.asp?node=88. Other products, such Transcrypt's Tactical Interoperability Kit (TIK) and BK Radio's V Series APCO P25, also provide public safety agencies with cross-banding options to achieve a certain level of interoperability. *See, e.g.,* http://www.relm.com/V_series_digital-analog_station.asp.

[30] *See* Seybold Comments at 3 (stating that nationwide Internet Protocol version 6 (IPv6, a next generation protocol designed to replace the current version 4, should be established to interconnect all federal, state and local first responder agencies by establishing a new stand-alone system that is secure and built to exacting standards, rather than connecting to the Internet).

[31] The term Wi-Fi was originally applied to unlicensed wireless devices operating in the 2.4 GHz band in accordance with the Institute of Electrical and Electronics Engineers (IEEE) 802.11b standard. More recently, however, the term has also been applied to unlicensed wireless devices operating in the 5 GHz region in accordance with IEEE 802.11a. *See* Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, *Notice of Inquiry*, GN Docket No. 04-54, 19 FCC Rcd 5136, 5144 n.30 (2004) (*Advanced Telecommunications Capability NOI*). In general, 802.11 standards refer to a family of specifications developed by the IEEE for wireless LAN technology. The Commission does not require devices operating in either the 2.4 or 5 GHz bands to meet the IEEE standards, however. For more information on 802 standards, see the IEEE web-site at http://www.ieee.org/portal/site.

frequency radio waves, rather than wires, to communicate between nodes, which can be laptops, Personal Digital Assistants (PDAs), and other devices. The term Wi-Max, short for "Worldwide Interoperability for Microwave Access," refers to two 802.16 standards developed by IEEE for fixed wireless broadband access systems.[32] The availability of Wi-Fi and Wi-Max technologies permit emergency response providers to communicate information among other personnel in the field, as well as with command centers and other locations.

Municipalities and public safety agencies report that they are pursuing the use of Wi-Fi and Wi-Max technologies, especially for the provision of non-mission critical communications, because they offer an efficient and economic means for public safety to attain an intermediate level of interoperability.[33] For example, one of the largest Wi-Fi/Wi-Max networks provides access to emergency response providers throughout nearly 700 square miles of territory located in three counties in the States of Oregon and Washington.[34] One police chief with access to the system reports, "We believe we are saving about 2000 man hours a year by going mobile. Now we can access every aspect of our report writing and our records management system – booking photos, past history, any cases that you want to read – from anywhere in the city and beyond."[35] Other municipalities are considering similar systems. For instance, New York City reports its consideration of a citywide mobile wireless network using a number of technologies including Wi-Fi and Wi-Max.[36] The City of Seattle also reports support for "wireless networking which supports propagation through buildings, real time video, large file transfers, enhanced mission-specific (police, fire, utility) applications, special geographic (map-based) presentations, simplified user interfaces, and use of [VoIP] for interoperability and redundancy."[37]

We note that some public safety agencies are generally reluctant to rely on the use of commercial wireless services, as well as certain technologies, such as Wi-Fi, that can be used in commercial applications, especially for the provision of mission-critical communications, due to concerns over

[32] Specifically, the 802.16a standard is used for systems operating between 2 and 11 GHz, while the 802.16b standard is used for systems operating between 10 and 66 GHz. *See Advanced Telecommunications Capability NOI*, 19 FCC Rcd at 5144 n.30. Wi-Max systems have a maximum speed of 75 Mbps and a theoretical range of 30 miles under ideal conditions but require a clear line of sight. *See id.* For more information on 802 standards, see the IEEE web-site at http://www.ieee.org/portal/site.

[33] For example, public safety personnel can access data and communicate with devices anywhere on the network. In addition, one LAN can be connected to other LANs over any distance via telephone lines, radio waves, or both to create a wide-area network (WAN).

[34] *See* Blake Harris, *Public Safety Key for Largest Wi-Fi Network in U.S.*, Digital Communities (Oct. 20, 2005). The network was funded in part with a grant from the Department of Defense (DOD) in order to provide emergency response providers and public safety personnel across the region with an interoperable system to enable a coordinated response and to facility an emergency evacuation of the area. *See id.* BellSouth recently announced the expansion of its wireless broadband service to businesses and customers in Gulfport and Biloxi, Mississippi who sustained long-term damage after Hurricane Katrina and require communications capabilities as they rebuild. *See* BellSouth Expands Wireless Broadband Service into Mississippi Gulf Coast, *Press Release* (Dec. 6, 2005).

[35] *Id.*

[36] *See* NYC Comments at 9-11.

[37] *See* Seattle Comments at 1; FPIC Comments at 4-5. The need for redundancy continues to be a prime concern to public safety agencies. For example, ARRC contends that commercial wireless services "do not lend themselves to the same backup power, site security and redundancy measures employed by dedicated and closed public safety radio networks." AARC Comments at 2; *see also, e.g.,* RPC 12 Comments at 3 (stating commercial wireless technologies are continually rendered inoperable during critical events when reliance is most critical).

interference and network access security. Because networks employing Wi-Fi technologies generally operate on an unlicensed basis in accordance with Part 15 of the Commission's rules,[38] there is a potential for harmful interference to public safety operations. For example, Grundy County states, "public safety cannot rely on unlicensed or commercial technologies to meet [its] mission critical broadband applications,"[39] and submits that "experience shows that only dedicated communications systems designed specifically for public safety needs provide the reliability, features and flexibility [necessary] for critical internal communications."[40] Milwaukee PD also notes the network security issues posed by the use of such commercial wireless technologies.[41]

Wireless mesh technology. Wireless mesh technology also promises users the ability to transmit information at high speeds and with high service quality through the most efficient route to its destination. In a wireless mesh network, the access point is connected to a wireless router,[42] which scans radio connections to find the least congested path and, in turn, hands off a network transmission to one or more other routers before the signal reaches a wired connection.[43] Indeed, proponents of wireless mesh state that the routing protocols create enormous efficiencies and capabilities and have evolved to deliver wireless broadband.[44] These advances reportedly eliminate the excessive routing overhead and signal degradation associated with multiple hops, making possible the deployment of larger metropolitan scale networks possible.[45] Motorola reports that "the most practical way to extend the range of broadband wireless communications in a power restricted environment is to hop through intermediate wireless routers, which can receive and retransmit the signal."[46]

Deployment efficiencies may also result from the non-proprietary character of the wireless mesh

[38] *See* 47 C.F.R. Part 15. As noted in these rules, all users of the unlicensed spectrum are treated equally and accept "interference rights" between and among other users.

[39] Grundy County Comments at 1.

[40] *Id*.

[41] Milwaukee PD Comments at 1.

[42] The access point and wireless router often are combined into one device.

[43] From its inception in the late 1970s, the routing protocols for wireless mesh networks were premised on communicating between mobile points, rather than accessing a wired network such as the Internet, and therefore emphasized reducing, if not eliminating, the number of hops a communication would take across the network to its destination.

[44] For example, Tropos Networks (Tropos), reports that its router dynamically identifies the most efficient path from router to router across multiple hops and achieves the highest throughput between the user's device and the wired backhaul connection. *See* Letter from Ellen M. Kirk, Tropos Networks, to the Honorable Kevin J. Martin, Chairman, FCC, WT Docket No. 05-157 at 3 (Nov. 2, 2005) (Tropos Letter). Tropos explains that its routing protocol adapts based on changing interference, fading conditions, or the addition of new backhaul to expand coverage. *See id.* The term "backhaul" generally refers to the transport links that carry traffic and network control information between base stations and other network elements, primarily mobile switching centers.

[45] Indeed, the range of wireless mesh broadband applications currently being used by municipalities and public safety agencies include video, photographs, VoIP, Internet access, secured database access, surveillance, report transmission and monitoring. *See* Tropos Letter at 3. According to Tropos, the technology delivers symmetrical service, up to 15 Mbps of concurrent subscriber capacity per square mile with peak data rates of up to 54 Mbps. *See id.*

[46] Motorola Oct. 27, 2005 *Ex Parte* (Mesh Networking Technology – Ultimate Evolution of Wireless Communications).

technology, which is generally designed around the 802.11 Wi-Fi standard.[47] As such, public safety agencies may rely on various devices manufactured in accordance with the 802.11 Wi-Fi standard to access the wireless mesh mobile broadband network, including laptops, PDAs, and VoIP phones. The wide availability and standardization of 802.11 compatible devices offer public safety agencies a cost-effective means for emergency responders to maintain equipment capable of achieving interoperable communications when their units are within range of the wireless mesh network.[48]

Wireless mesh broadband networks also can be deployed from scratch in just a few days following a major event in order to restore communications.[49] Routers for mesh networks can be attached to lampposts, telephone poles or other fixtures with a power source.[50] Back up power supply, whether battery or solar panels can be affixed at the time of installation or later. Mesh networks can expand or be altered without needing to return to adjust routers already in place.[51] The lack of proprietary devices and the flexible deployment capability of wireless mesh networks offer public safety agencies a broad range of mobile broadband communications to provide effective interoperability among other uses. For example, in Cedar Rapids, Iowa, city buses have been broadband-enabled wirelessly to improve security and entertainment for riders via a 2.4 GHz mobile mesh-networking solution. Wireless mesh networks also were effectively deployed in twenty-two areas in New Orleans and the Gulf Coast after hurricane Katrina to restore voice and data service.[52]

Finally, as noted earlier with respect to Wi-Fi and Wi-Max, wireless mesh networks are also susceptible to the potential for harmful interference.

Cellular technologies. Cellular technologies offer "anytime, anywhere" mobility, an important tool for emergency responders.[53] At a very basic level, a number of commercial wireless service providers that offer extensive nationwide, regional, or even discrete coverage could supplement public safety communications in areas where public safety systems do not have coverage or could not economically duplicate coverage.[54] In this regard, emergency response providers and commercial

[47] Wi-Fi and the 802.11 standard are discussed above. For example, PacketHop, Inc. (PacketHop) offers mobile mesh networking software that enables any 802.11 standard-based device, such as laptops, PDAs, and devices with similar interconnection capabilities, to send, receive and route data.[47] The technology allows users to form an extended Wi-Fi hot-zone, which can operate with or without wireless access points. Specifically, the PacketHop Communication System consists of the TrueMesh mobile mesh networking software and the Aware™ for Public Safety multimedia application with capabilities such as real-time multicast video, resource tracking, and instant messaging.

[48] Tropos notes that, in a typical public safety environment, there are approximately twenty routers per square mile, with the cost per square mile of less than $100,000. *See* Tropos Letter at 3.

[49] *See* Tropos Letter at 5. Wireless mesh technology also generally provides a greater degree of resiliency against link and node outages and, according to Tropos, ensures that there is no system level point of failure. *See id.*

[50] *Id.* at 4.

[51] *Id.*

[52] *See id.* at 2-4.

[53] The States of Pennsylvania, Michigan, and Colorado have each employed cellular technologies to enhance the interoperability of public safety personnel on a statewide basis. *See* CTIA Comments at 3-4.

[54] *See, e.g.*, Enterprise Comments at 5 (stressing that the cost of commercial services has decreased and reporting that SouthernLINC's "advanced network has allowed public safety entities to avoid the costs involved in constructing and maintaining their own systems").

wireless carriers could work together to design, configure or share systems to facilitate basic mobile communications or enable interoperability among different public safety agencies over wide or unique areas where individual communication systems are not interoperable or do not have overlapping coverage.[55]

More specifically, a number of commercial wireless providers offer (or soon will offer) a "push-to-talk" (PTT) option that enables easy one-on-one and one-to-many half-duplex communications, thereby granting emergency response providers a communications option equivalent to many existing public safety systems. PTT allows the mobile phone, when in a special mode, to function as a digital two-way radio in PTT operation (in a fashion similar to the "trunking" feature of newer commercial and public safety two-way radios). Only one person at a time can talk, by pressing a PTT button, and one or several others can listen instantly. The service connects mobile phone users with each other within seconds. PTT commonly does not deplete regular airtime minutes, and uses the General Packet Radio Service[56] connection, on which the amount of data transmitted is billed, rather than the minutes of conversation. Although PTT enables rapid communication, which is critical especially in times of emergency or for public safety operations deployed to provide relief after natural disasters, PTT is not currently interoperable -- users currently must utilize to the same mobile carrier's network in order to talk with one another.

Wireless priority service (WPS) is also notable given that it relies on commercial wireless technology to provide an end-to-end nationwide wireless priority communications capability during natural or man-made disasters or emergencies that cause congestion or network outages in the Public Switched Telephone Network (PSTN).[57] Key federal, state, local and tribal government and critical infrastructure personnel that have national security and emergency (NS/EP) missions are eligible to participate. The Commission approved the WPS for NS/EP requirements on a call-by-call priority basis and maintains oversight responsibilities for the WPS Program.[58] The National Communications System (NCS) manages the day-to-day administration on behalf of the Executive Office of the President.

Under the Commission's WPS rules, authorized NS/EP users in emergencies may gain access to the next available wireless channel to originate a call; however, the priority calls would not preempt calls in progress. Specifically, WPS is an enhancement to basic mobile service that allows NS/EP calls to queue for the next available radio channel. The full WPS capability provides priority handling from the origination, through the network, to the called destination. In adopting the WPS rules, the Commission required wireless carriers that elect to offer WPS to adhere to uniform operating protocols concerning the number of priority levels and specific priority levels for particular NS/EP users. WPS rules provide for five levels of priority as requested by NCS. WPS is available to authorized NS/EP users at all times, and

[55] *See, e.g.*, National Institute of Justice Journal, April 2000, *Can We Talk? Public Safety and the Interoperability Challenge* at 19 ("Although there is no silver bullet or single solution to achieving interoperability, several approaches can foster enhanced communication among agencies . . . [and] [s]ome public safety agencies are . . . [u]sing products and services that traditionally have been sold only to consumers, such as satellite paging systems, cellular phones, and personal communication systems . . . that transmit both voice and data. These alternatives are helping to alleviate existing public safety spectrum congestion and to expand the geographic boundaries of signal areas.").

[56] GPRS is a new non-voice value added service that allows information to be sent and received across a mobile telephone network. This technology today's Circuit Switched Data and Short Message Service. We note that GPRS is not related to GPS (the Global Positioning System), a similar acronym that is often used in mobile contexts.

[57] For more information on the Wireless Priority Service, *see* http://wps.ncs.gov.

[58] *See* 47 C.F.R. § 64.402, App. B.

is triggered on a per call basis when the user dials a feature code.

For users, WPS costs are a one-time activation charge of no more than $10, a service fee of no more than $4.50 per month, and no more than a $ .75 per usage fee for WPS calls. Carrier participation in the WPS program is voluntary. To encourage participation, the NCS is funding the technical development and implementation of priority features in the carrier networks. Three commercial wireless carriers, each of which employ the GSM air interface,[59] are under contract to provide WPS. T-Mobile and Cingular provide service to most of the fifty states. Sprint Nextel provides service to numerous locations throughout the nation. Although no carrier employing the CDMA air interface[60] currently offers PAS, Verizon Wireless will begin to offer the service in spring 2006.

Mobile infrastructure. Whenever public safety relies on a network for critical safety of life communications, that network should be resilient enough to rebound quickly after a major event – even if the major event disables the local infrastructure. Therefore, public safety entities may greatly benefit from utilizing mobile infrastructure that could quickly re-establish communications after such a disastrous event. The mobile infrastructure should operate independent of the damaged local infrastructure. Indeed, a robust interoperable network must be able to function in all areas served by emergency response providers, including areas where most of the communications infrastructure is degraded or non-existent.

Most radio networks may use temporary mobile antenna structures to augment or temporarily replace existing infrastructure in the case of natural or other damage to the network facilities. This includes mobile antennas mounted on such forms as cells-on-wheels, inflatable balloons at high altitude,[61] temporary installations like aircraft or tall buildings, or other semi-permanent structures. It is important to recognize however, that the antennas are only a small portion of the transmission facility that must be used. Antennas are typically constructed to provide some height to the actual transmitting/receiving elements in order to increase the range of the radios being used. In this context, the antennas are an adjunct to the actual radio transmission equipment; hence, the mobile facilities would include not only the antennas but also the radio transmission and receiving equipment, as well as electrical power and other support requirements.

For instance, mobile communications vehicles containing complete RF infrastructures, power systems, towers and repeaters can be brought into a scene where the local infrastructure has been disabled

[59] The Global System for Mobile Communications (GSM) is a digital air interface for wireless systems that divides each wireless channel into eight discrete time slots, which allows up to eight simultaneous calls using the same frequency.

[60] The Code Division Multiple Access (CDMA) is a "spread spectrum" technology, allowing many users to occupy the same time and frequency allocations in a given band/space. As its name implies, CDMA assigns unique codes to each communication to differentiate it from others in the same spectrum.

[61] Space Data Corporation (Space Data) has developed special radio platforms, known as SkySite® Platforms, to provide "the functionality of a standard wireless base station that is located on the ground, but weighs less than six pounds and is lofted by a balloon to an altitude over 65,000 feet effectively creating an antenna over 10 miles high." Letter from Gerald M. Knoblach, Chairman and CEO, Space Data Corporation, to Honorable Kevin J. Martin, Chairman, FCC, WT Docket 05-157 (dated Nov. 18, 2005) at 3 (Space Data *Ex Parte* Letter). The balloons allow the radio equipment to "float" in "near space" – between 12 and 62 miles above sea level – to provide 12 to 24 hours of coverage before being parachuted safely back to earth and recovered. *See id.* at 3-4. Space Data notes that the SkySite Platforms "fly much higher than storms and fires, they can provide communications during the disaster itself. Immediately afterward, they can provide wide-area communications so that the radios carried by police, fire, medical and National Guard personnel can reach across the entire affected area." *Id.* at 6.

for the purpose of re-establishing terrestrial communications for emergency response providers.[62] In addition, satellite communications can be re-established using lightweight, inflatable antennas. These 2.5 meter antenna systems can be established rapidly by inserting stakes into the ground, inflating an antenna ball and pointing it at a satellite. Such a system was recently used in Harrison County, Louisiana to re-establish an Internet connection in the wake of hurricane Katrina.[63]

Mobile transmission facilities would provide a national broadband network with the flexibility to respond to failures within the system as well as to augment the system in response to a large-scale incident or a surge in service demand beyond what is normally provided in a region. In these contexts, the facilities would permit a rapid restoration or expansion capability, however, this additional capacity would come at a significant increase in cost.

III. Conclusion

Earlier wireless commercial services may not have entirely satisfied the communications needs of the public safety community. Today's commercial wireless systems and technologies offer the potential to meet present and expanding public safety needs, especially with respect to non-mission critical duties.

[62] *See, e.g.*, Motorola Deployable Communications Systems at http://www.motorola.com/governmentandenterprise/northamerica/en-us/public/functions/browsesolution/browsesolution.aspx?navigationpath=id_801i/id_827i/id_2287i.

[63] *See* http://www.mda.mil/mdalink/pdf/05fyi0065.pdf.

Appendix C

Use of Commercial Satellite Technologies and Services

I. Introduction

Commercial wireless technologies include commercial satellite services. The Commission has recognized that commercial satellite services are well suited for the provision of emergency communications.[1] A robust interoperable network must be able to function in all areas served by emergency response providers,[2] including areas where communications infrastructure is degraded or non-existent. Satellite services can play a role in a robust, interoperable[3] network for emergency response providers by providing ubiquitous, reliable coverage throughout the United States. Furthermore, they are generally immune from natural and manmade disasters. Thus, the incorporation of commercial satellite services into an interoperable public safety system that also includes terrestrial wireless systems would help to ensure that effective communication services are available to emergency response providers.[4]

As illustrated below, federal, state and local emergency response providers are already using commercial satellite services either as stand-alone platforms or as part of an integrated satellite terrestrial network to enable a range of voice, data, video, and other services. We begin with a brief overview of the

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[1] *See, e.g.*, Establishing Rules and Policies for the Use of Spectrum for Mobile Satellite Service in the Upper and Lower L-band, *Notice of Proposed Rulemaking*, 11 FCC Rcd 11675, 11681 ¶ 12 (1996) (noting that satellites "provide emergency communications to any area in times of emergencies and natural disasters"); Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service, *Notice of Proposed Rulemaking*, 10 FCC Rcd 3230, 3231 ¶ 7 (1995) (noting that satellites "provide nationwide public safety coverage. . . . [and] could satisfy important requirements that cannot be economically satisfied by other means"); Qualcomm Incorporated, *Order*, 15 FCC Rcd 21444, 21446 ¶ 6 (WTB 2000) (explaining that satellites "may provide an important additional emergency telecommunications resource, especially to callers located in remote and rural areas and callers located in under populated regions where neither landline nor terrestrial mobile services exists"); Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands, *Report and Order*, 18 FCC Rcd 1962, 1978 ¶ 29 (2003) ("By offering ubiquitous coverage with instant, nationwide interoperability, ATC-enhanced MSS may make the public, law enforcement, and public-safety organizations easier to reach in the field, regardless of location. Accordingly, MSS ATC may enhance the nation's overall ability to maintain critical telecommunications infrastructure in times of crisis or disaster.").

[2] *See* Dale Hatfield and Phil Weiser, "Taking A Fresh Look At Public Safety's Spectrum Needs: Toward A Next Generation Strategy For Public Safety Communications" (MSV/Hatfield White Paper) at 4. An updated version of the MSV/Hatfield White Paper, which takes into account the experience gained from hurricanes Katrina and Rita, may be accessed at http://www.msvlp.com/nextgen/news/_pdf_launch_/NextGenOct21R2.pdf.

[3] The Commission has defined "interoperability" as "[a]n essential communications link within public safety and public wireless communications systems which permits units from two or more different entities to interact with one another and to exchange information according to a prescribed method in order to achieve predictable results." Development of Operational, Technical, and Spectrum Requirements for Meeting Federal, State, and Local Public Safety Agency Communication Requirements Through the Year 2010, *First Report and Order*, 14 FCC Rcd 152, 189-90 ¶ 76 (1998).

[4] *See* Iridium Comments at 1 n.3; MSV/Hatfield White Paper at 14 ("Increasing their reliance on commercial systems… does not mean that public safety agencies should abandon their existing private LMR systems."); TerreStar Comments at 3 ("Although public safety agencies could still rely on their existing [LMR networks], by incorporating access to an MSS/ATC network in their communications equipment, these agencies could ensure the ability to talk with any other user in the country whose equipment is also MSS/ATC-enabled.").

existing commercial satellite infrastructure, and then set forth the numerous ways that emergency response providers are using commercial satellite services to enable a range of voice, data, video, and other services, often in situations where existing terrestrial infrastructure is degraded or non-existent. We conclude by summarizing the ways satellite services can continue to play a role in supporting emergency response providers.

II. Background

A. Existing Satellite Infrastructure

Space segment. The space segment consists of the satellites in orbit. Each satellite consists of transponders, which receive radio signals, amplify them, and re-transmit them back to earth, usually at a different frequency than that with which the signal was received.[5] Commercial satellites typically have an operational lifespan of 15 years or more. An FCC satellite license generally authorizes the satellite to serve the entire United States, if it is technically capable of doing so.

Comments state that the satellite space infrastructure is highly suitable for use by emergency response providers. For example, comments stress that satellites can provide ubiquitous coverage, including urban and rural areas,[6] waterways and coastal areas,[7] the nation's airspace,[8] and the territories of neighboring nations.[9] Comments also assert that satellites are highly reliable, since their operational altitudes make them effectively immune from natural and man-made disasters.[10] Furthermore, comments note that, because satellites are generally authorized to provide nationwide coverage, they can deploy

[5] Commercial satellites operate in two broad orbital classes: the geostationary orbit (GSO) and non-geostationary orbit (NGSO). GSO is a circular orbit along the plane of the Earth's equator at an altitude of 35,786 kilometers. A spacecraft in geostationary orbit can be maintained at a constant longitudinal position relative to the Earth, thus allowing the satellite to be "seen" continuously from, and at a fixed orientation to, any given point on the Earth's surface. GSO is used for the majority of satellite video, voice, and data services, as well as for direct-to-home and direct broadcast satellite services. All other orbits are classified as NGSO. Because NGSO satellites do not remain at a constant position relative to the Earth, NGSO systems generally require a constellation of multiple satellites in order to provide nation-wide or global coverage. Today, in the geosynchronous orbit, there are approximately 90 FCC-licensed active commercial communications satellites and over 40 non-U.S. satellites authorized to serve the United States. In non-geostationary orbits, there are 170 FCC-licensed satellites.

[6] Iridium Comments at 2 ("One of the greatest benefits to emergency responders of the Iridium system is its expansive geographic coverage. Iridium's system covers all operating areas, including rural areas and open ocean."); SIA Comments at 3 ("unlike any other communications technology, satellites are capable of providing truly ubiquitous coverage, from the most rural areas to the densest urban cores. This is critically important in remote areas that lack adequate telecommunications infrastructure.").

[7] Iridium Comments at 2 ("Iridium's system already provides the United States Coast Guard with beyond the horizon communications over all U.S. waterways, oceans, and polar routes using a single phone, a single frequency, and a single network."); SIA Comments at 3-4. ("Moreover, unlike terrestrial systems, satellite systems provide coverage not only of the nation's land mass, but of the skies above and of inland and surrounding waterways as well.").

[8] SIA Comments at 3-4.

[9] SIA Comments at 6-7 ("satellites can even allow for international interoperability. Satellites provide coverage not only of the United States, but of Canada, Mexico, the Caribbean, and points beyond as well.").

[10] SIA Comments at 5. While failures of satellites in-orbit do occasionally occur, many satellite operators have in-orbit spares that are capable of substituting for the failed satellite, or are able to transfer traffic to other satellites. *Id.*

resources flexibly to areas of the country most in need of communications capabilities.[11]

Satellite infrastructure also imposes some limitations. Satellites require long construction lead times and involve considerable costs.[12] In addition, a commercial satellite cannot be reconfigured once in orbit. The high altitudes used by satellites can also result in latency in communications.[13] Although latency is less critical for data or broadcast transmissions, it can be noticeable where immediate response is necessary, such as two-way voice communications.

Ground segment. Some satellites can communicate directly with each other via inter-satellite links, but most satellite communications are relayed through ground facilities, called earth stations. An earth station may be a telemetry, tracking and control (TT&C) facility that monitors and controls a satellite. It may also be a hub station that connects remote users with a central facility, or a gateway station that connects satellite users to the public switched telephone network (PSTN) or other terrestrial networks. Earth stations may also be devices familiar to the public, such as a very small aperture terminal (VSAT)[14] atop a business or retail store, a satellite television dish, or a satellite telephone.

Earth stations can be fixed or mobile. Fixed stations are located at a specified point permanently, or may be moved from one spot to another within the licensed service area. In either case, most fixed stations do not transmit while moving.[15] Mobile earth stations, on the other hand, may be moving during transmissions. The FCC licenses earth stations either individually or pursuant to a "blanket license" that allows the operation of a large number of technically identical stations. The FCC typically does not require licenses for receive-only earth stations that are not capable of transmitting.

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[11] SIA Comments at 6 (stating that "a fixed satellite link serving rural education with a continental-United States (CONUS) satellite beam could readily be reassigned to support a disaster recovery application in a different place in the country. Similarly, an MSS provider could divert switched capacity from one portion of the country to another to support a disaster recovery effort.").

[12] Depending on the complexity of the satellite mission, it can take from 30 months to 7 years to design and construct a satellite system. Construction and launch costs for a satellite, not including ground equipment, can range from US $180 million to US $400 million for a single GSO satellite, to several billion dollars for a multi-satellite NGSO satellite constellation.

[13] Latency is the time delay between when a transmission is sent and when it is received. Signals must be sent up to the satellite and then sent down to Earth. At GSO altitudes, it takes about a quarter of a second for this trip. Because NGSO satellites frequently operate at lower altitudes, the total path is shorter and the delay is less.

[14] A network of small remote terminals, such as a VSAT network, generally has three components: (1) A central hub earth station; (2) the satellite; and (3) a virtually unlimited number of remote terminals in various locations across a country. Content originates at the hub earth station, which features a large (4.5 -11 meter) antenna. The hub controls the network through a network management system. Outbound information (from the hub earth station to the remote terminals) is sent up to the communications satellite's transponder, which receives it, amplifies it, and beams it back to earth for reception by the remote terminals. For remote terminals that are authorized to both send and receive, the remote terminals send information inbound via the same satellite transponder to the hub earth station. This arrangement, where all network communication passes through the network's hub processor, is called a "star" configuration, with the hub station at the center of the star. "Mesh" configurations also allow for direct communication between the remote terminals (again, where authority is both transmit and receive).

[15] An exception is Earth Stations onboard Vessels (ESVs), which are classified as fixed earth stations but are permitted to transmit while the vessel is in motion. *See* Procedures to Govern the Use of Satellite Earth Stations on Board Vessels in the 5925-6425 MHz/ 3700-4200 MHz Bands and 14.0-14.5 GHz/ 11.7-12.2 GHz Bands, *Report and Order*, IB Docket No. 02-10, 20 FCC Rcd 674 (2005).

Comments stress that the flexible nature of earth stations make them highly reliable. Although earth stations are susceptible to disasters on the ground or electric power grid failures, satellite operators state that earth stations are deployed in geographically diverse locations to avoid a single point of failure.[16] Where earth stations are rendered inoperable in a crisis or natural disaster, they can often be replaced, at least on a temporary basis, with transportable earth stations in order to restore communications.[17] Comments indicate that satellite services often use off-the-shelf equipment that is small, lightweight, mobile, and that is often available on either a purchase or rental basis, which increases its flexibility and interoperability.[18] Furthermore, comments stress that earth stations typically employ digital communications with a high degree of security.[19]

Earth stations generally require line-of-sight with the satellite. As a result, obstacles such as buildings, mountains, or heavy foliage may block satellite signals. To avoid signal blockage, satellite operators are incorporating terrestrial transmitters in conjunction with their satellite networks. For example, satellite radio operators rely on terrestrial repeaters to boost satellite signal strength in areas where a strong signal from a satellite is not possible.[20] Mobile satellite telephony operators plan to add an ancillary terrestrial component (ATC) to their satellite networks, which uses terrestrial transmitters on the ground for communications where it is not possible to communicate with a satellite directly.[21] In addition, repeaters are being introduced in buildings to allow the use of satellite consumer handsets indoors.[22]

[16] SIA Comments at 5.

[17] For examples of temporary restoration using transportable earth stations, see the "Instant Infrastructure" discussion, *infra*.

[18] Iridium Comments at 3-4.

[19] Iridium Comments at 3 (discussing the ability to implement NSA accredited type 1 secure encryption capabilities into all of its handsets); MSV/Hatfield White Paper at 11 (discussing implementation of Public Key Infrastructure and NSA type 1 encryption in MSV's ATC network).

[20] Establishment and Rules and Policies for the Digital Audio Radio Satellite Service in the 2310-2360 MHz Frequency Band, *Report and Order, Memorandum Opinion and Order and Further Notice of Proposed Rulemaking*, IB Docket No. 95-91, 12 FCC Rcd 5754 (1997).

[21] The Commission issued the first ATC authorization in 2004. *See* Mobile Satellite Ventures Subsidiary LLC, *Order and Authorization*, 19 FCC Rcd 22144 (Int'l Bur. 2004). *See also* Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4 GHz Bands, *Report and Order and Notice of Proposed Rulemaking*, IB Docket Nos. 01-185 and 02-364, 18 FCC Rcd 1962 (2003).

[22] *See, e.g.*, Applications of Iridium/Eagle Broadband to incorporate terrestrial signal boosters inside buildings (IBFS File Nos. SES-MOD-20050927-01329; SES-MOD-20050927-01330; SES-STA-20050930-01349; SES-STA-20050930-01350).

B. Spectrum Resources and Satellite Services

Commercial satellites communicate generally use radiofrequencies in the microwave band, with frequencies greater than one gigahertz. No commercial satellite allocations exist in the 700 MHz frequency band, although amateurs conduct satellite communications in nearby frequencies, so satellite operations are technically possible at these frequencies.[23]

II. Use of Commercial Satellite Services During Emergencies

Although satellite telephony is most frequently cited as a possible component in a nationwide interoperable emergency communications network, other commercial satellite services are currently being used by emergency response providers as well. As detailed below, commercial satellite services are already being used today by local police and fire departments, state agencies, the United States Coast Guard, FEMA, and the American Red Cross, among others.[24] Increased integration of commercial satellite services as part of an emergency communications network is possible as emergency response providers become familiar with the capabilities of satellite service providers.[25]

A. Mobile Telephony and Data

Satellite telephones are repeatedly relied upon by emergency response providers due to their ability to operate in crises and disasters when existing terrestrial infrastructure is non-existent or has been degraded or destroyed.[26] The satellite networks of mobile-satellite service (MSS)[27] providers were utilized in the aftermath of the terrorist attacks of September 11, 2001,[28] and during the hurricane season

[23] There may, however, be some impact on satellite system design that could arise from operating at 700 MHz. For example, satellites generally use high gain, highly directive antennas because they need to receive relatively weak signals transmitted at a great distance. These highly directive antennas also permit a satellite to re-use frequencies more, thereby increasing the system's traffic capacity. At lower frequencies, such as 700 MHz, antennas on a satellite, satellite earth station, or satellite handset would have to be bigger in order to obtain the same gain or directivity. In some cases, it may not be feasible to have larger antennas. Without higher gain antennas, power consumption and re-use of frequencies might be constrained.

[24] *See* SIA Comments at 7.

[25] *See* TR Daily, "Public Safety Agencies Urged to Consider Greater Use of Satellites," November 17, 2005 (reporting that the public safety community plans to ask representatives of the satellite industry to make presentations at its conferences to familiarize state and local agencies with the services offered).

[26] Iridium Comments at 2 (stating that independence of satellite system "allows organizations operating in one area to communicate across the world via a satellite system without having to rely on terrestrial systems that may be destroyed during a disaster"); MSV/Hatfield White Paper at 13 ("Unlike most commercial networks, hybrid satellite-terrestrial systems can be used when the local power grid fails"); TerreStar Comments at 2 ("An MSS/ATC system is uninterrupted by a failure in the power grid; handsets can seamlessly switch from a terrestrial network to a satellite if a base station becomes unavailable").

[27] MSS is a satellite service that connects mobile earth stations. *See* 47 C.F.R. § 2.1(c). MSS systems operate in several different frequency bands (such as L-band and 2 GHz) and utilize both GSO and NGSO satellites to provide mobile voice and data services to a variety of mobile terminals (including hand-held terminals) and to fixed terminals.

[28] *See* TerreStar Comments at 1, citing New Part 4 of the Commission's Rules Concerning Disruptions to Communications, *Report and Order and Notice of Further Proposed Rulemaking*, ET Docket No. 04-288, 19 FCC Rcd 16830, 16838 (2004) (observing that after September 11, "satellite communications . . . were used to initiate the (continued….)

of 2004.[29] Most recently, a single MSS provider deployed more than 10,000 satellite phones in the Gulf Coast in the aftermath of hurricane Katrina, and another MSS provider estimated that its usage levels were 30 times higher than average in the Gulf Coast as a result of the hurricane.[30] MSS units provide interoperable connections between emergency responders and other communications networks,[31] and can even link U.S. emergency response providers with counterparts in neighboring countries.[32] In addition, MSS systems can be designed to provide priority access to public safety operators to assure reliable communications even during times of heavy call volumes.[33] As MSS systems are developed commercially, commenters expect that the cost of such systems will decline, their capabilities will increase, and their use among emergency response providers will become more widespread. [34]

MSS systems are not limited to voice communications or use only during emergencies. For example, the New Mexico State Police (NMSP) is using MSS systems in order to provide its personnel with communications capability in the 15% of the state that is not covered by its Land Mobile Radio (LMR) network.[35] By using existing commercial MSS satellite infrastructure, NMSP personnel have access to data-access, as well as push-to-talk, capabilities throughout all of New Mexico, both during normal law enforcement operations and during emergencies.[36]

In addition to this existing technology, mobile satellite telephony operators are adding terrestrial transmitters as an ancillary terrestrial component to their satellite networks in the near future to permit satellite-based communications where a direct line of sight with a satellite is not possible, such as in urban areas where satellite signals can be blocked by buildings.[37]

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movement of equipment and personnel into the affected areas for restoration purposes and to coordinate [first responders'] work.").

[29] *See* Peter J. Brown, "Emergency Communications: Satellite Solutions Emerge For Disaster Response," Via Satellite, January 2005, at 22 (describing use of mobile satellite telephones by state emergency agencies during hurricanes Charlie, Frances, Ivan, and Jeanne in 2004).

[30] "Sat Phone Surge after Katrina," Wired News, September 7, 2005, available on-line at http://www.wired.com/new/print/0,1294,68768,00.html).

[31] Iridium Comments at 3 (observing that its SkyConnect terminals are frequently linked directly to hospitals' PBX or hotlines to ensure communications in case of emergencies such as hurricanes or disasters in which normal communications are disrupted.)

[32] SIA Comments at 6-7 (stating that international scope of satellite services "is particularly useful in facilitating international cooperation in areas along the United States borders with Canada and Mexico.").

[33] MSV/Hatfield White Paper at 13 ("MSV is designing its system so that, in the case of emergency events, the public safety operators can enjoy priority access to the extent necessary to preserve public safety communications").

[34] *See* MSV/Hatfield White Paper at 12 (noting that hybrid satellite-terrestrial systems would enable public safety agencies "to benefit from the considerable economies of scale and enhanced functionalities that commercial providers can offer"); SIA Comments at 7-8 (noting that public safety agencies will benefit from the next generation mobile-satellite systems that will offer smaller, lighter, and more powerful portable terminals).

[35] MSV/Hatfield White Paper at 5.

[36] MSV/Hatfield White Paper at 12.

[37] The Commission issued the first ATC authorization in 2004. *See* Mobile Satellite Ventures Subsidiary LLC, *Order and Authorization*, 19 FCC Rcd 22144 (IB 2004); *see also* Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Bands; Review of the Spectrum Sharing Plan Among Non-Geostationary Satellite Orbit Mobile Satellite Service Systems in the 1.6/2.4
(continued….)

B. "Instant" Infrastructure

Satellite services already play a significant role in ensuring rapid restoration of communications infrastructure in the aftermath of a natural disaster or crisis, and in making available communications infrastructure to emergency response providers in such events. Standing alone, temporary fixed-satellite service (FSS)[38] earth stations are a tremendous asset to emergency first responders by providing vital communications services. When linked with other existing off-the-shelf technologies, these earth stations can create an instant communications infrastructure for first responders.[39] Particularly compelling examples of the capability of FSS satellite services to provide an instant communications infrastructure when combined with other existing technologies are the mobile communications centers used by both FEMA and the American Red Cross. These vehicles operate as temporary FSS earth stations and are capable of providing data, video, or voice services.[40] The American Red Cross has a number of vehicles that allow communications on a wide range of frequencies across disaster areas. During the response to hurricane Katrina, the Red Cross vehicles were used effectively as part of a very small aperture terminal network that was in turn combined with existing technologies such as Wi-Fi[41] equipment and wireless

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GHz Bands, *Report and Order and Notice of Proposed Rulemaking*, IB Docket Nos. 01-185 and 02-364, 18 FCC Rcd 1962 (2003).

[38] FSS is a satellite service that connects earth stations located at specified fixed points or at variable fixed points within specified areas. *See* 47 C.F.R. § 2.1(c). FSS networks may operate with either GSO or NGSO satellites, and are licensed to operate in the C- (4/6 GHz), Ku- (12/14 GHz), and Ka-bands (18/29 GHz) to provide a range of data, voice, and video services, including broadband services.

[39] While MSS devices are inherently small and portable, FSS satellite services providers are also utilizing smaller and more portable earth stations that can be brought into areas where terrestrial communications are lacking. Some of these FSS earth stations are no larger than a suitcase and can facilitate a large array of communications services. *See* AVL Technologies, Application to Modify Blanket Earth Station License to Add 50 Each of 0.75, 0.96 and 1.0 meter Ku-Band Antennas, *Order and Authorization*, 19 FCC Rcd. 22,086 (2004) (modifying AVL's blanket earth station license to add 50 each of 0.75, 0.96 and 1.0 meter temporary-fixed earth station antennas); SWE-DISH Satellite Communications, Inc., Application for Authority to Operate a Single Temporary-Fixed Earth Station in the Ku-Band Fixed-Satellite Service, *Order and Authorization*, 19 FCC Rcd. 16,314 (2004) (granting Swedish authority to operate an elliptical 0.90x0.66 meter, transportable, transmit/receive earth station designed to provide an Internet Protocol (IP) gateway capable of providing various services, including digital video news gathering, internet connections (including VoIP), broadband access, and other common and non-common carrier services and designed to interface with numerous other electronic devices such as a portable computer, Moving Pictures Expert Group (MPEG) encoder and telephone interface).

[40] One type of vehicle used by FEMA is its Multi-Radio Vehicle (MRV) which comes equipped with a full suite of communications devices including a Ku-band satellite system which can provide connectivity for telephones, Local and Wide Area Network (LAN/WAN), compressed video teleconferencing, and Broadcast Video. For more information on FEMA's mobile communications vehicles go to http://www.fema.gov/rrr/mers04.shtm. *See also* Peter J. Brown, "Satellites Stand by High above the Hot Zone," Via Satellite, August 01, 2005 (describing the use of satellite technology by programs such as the Metropolitan Medical Response System, the multi-state Emergency Management Assistance Compact and the Disaster Management Interoperability Service (DMIS)). Other industries have also adopted the use of satellite enabled communications vehicles to respond to disasters. *See* "Emergency Extension: State Farm Insurance can Bring Nodes up in Disaster-Torn Areas in a Matter of Hours," NETWORKWORLD, May 2, 2005 (describing VSAT kits and VSAT vehicles used by State Farm to set up communications centers for processing claims).

[41] Wi-Fi, short for Wireless Fidelity, is a term used generically to refer to any product or service using the 802.11 series standards developed by the Institute of Electrical and Electronics Engineers (IEEE) for wireless local area network connections. The bandwidth is shared among multiple users. Wi-Fi enabled wireless devices, such as laptop computers or personal digital assistants (PDAs), can send and receive data from any location within signal (continued….)

laptops to allow for both VoIP telephone services and data. In some areas, these vehicles provided the only available voice communications.[42] Although MSS devices offer an instant mobile infrastructure for emergency responders, like fixed-satellite services they too can combine with other technology to offer innovative solutions for first responder.[43] For example, MSS devices can be combined with a miniaturized cellular switch or "pico cell" site, so that emergency workers can use their existing standard cell phones to call anyone on the PSTN, or other workers within the radius of the pico cell.[44]

The majority of satellite services provided in the immediate aftermath of hurricanes Katrina, Rita, and Wilma were provided pursuant to the operators' existing licenses, which allowed operators to rapidly deploy mobile telephony, data, radio and television services to the region.[45] Additional capacity and special regulatory measures were quickly granted, when needed. The authorizations granted pursuant to special regulatory measures[46] illustrate the many satellite services used in an emergency. For example, earth stations set up networks for data transmissions, internet access, and information sharing.[47] Similarly, special authorizations were also granted to provide connections for communications with emergency response providers.[48] Satellite services were also critical in the restoration of critical

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reach of a Wi-Fi equipped base station or access point (AP). Typically, mobile devices must be within approximately 300 feet of a base station.

[42] *See* "VoIP Demonstrates Strengths in Katrina Aftermath," New Telephony, September 6, 2005, available on-line at http://www.newtelephony.com/news/59h6122947.html.

[43] See discussion of "Mobile Telephony and Data," *supra*.

[44] *See* Globalstar Press Release, "Globalstar Develops Wireless Emergency Management Communications System for Disaster Response," October 4, 2005, available on-line at http://www.globalstar.com/en/news/pressreleases/press_display.php?pressId=384.

[45] The ability to deploy satellite infrastructure rapidly is due in large part to the flexibility of the Commission's rules and licensing process.

[46] The Communications Act of 1934, as amended, provides the Commission with the authority to grant temporary authorizations in extraordinary circumstances where such temporary operations are in the public interest and delay in operation would prejudice the public interest. 47 U.S.C. § 309(f). The Commission's Rules governing the issuance of special temporary authority (STA) are set-forth at 47 C.F.R. § 25.120 for satellite services and 147 C.F.R. § 1.931 for wireless services.

[47] *See e.g.*, IBFS File Nos. SES-STA-20050908-01224 (granting special authority to operate a 1.0 meter antenna to communicate with SATMEX-5 or Intelsat-Americas-7 satellites); SES-STA-2005-0908-0122 (granting special authority to operate a 1.2 meter transportable satellite dish on a Humvee to provide free VoIP and internet access in relief area).

[48] *See e.g.*, IBFS File Nos. SES-STA-20050927-01328 (granting special authority to operate a conventional Ku-band VSAT network (a 1.8 meter hub earth station and twenty 1.2 meter remote terminals) to provide service to FEMA); SES-STA-20050922-01310 (granting special authority to use a .96 meter Ku-band antenna to provide service to Motorola in support of the Louisiana state police); SES-STA-20050916-01269 (granting special authority to operate approximately twelve fixed, common carrier, transmit/receive remote earth stations in southern Mississippi and southern Louisiana to provide voice and data interconnectivity and Internet access to the Florida Emergency Operations Center and the Florida Department of Law Enforcement in their disaster relief efforts following hurricane Katrina); *see also* Letter to Raul R. Rodriguez, Esq., Counsel to MTN, from Scott A. Kotler, Chief, Systems Analysis Branch, Satellite Division, International Bureau, 20 FCC Rcd 16591 (2005) (granting a waiver of Section 25.221 of the Commission's rules to allow operation of three 2.4 meter C-Band earth stations on cruise line ships in the Gulf Coast to connect ships to Cingular trunk lines).

communications for construction companies, utilities, and oil refineries.[49]

C. Medical Assistance

MSS systems are being used to provide integrated voice and data applications to link medevac helicopters with hospital and operation centers.[50] Some emergency responders are already using satellite systems for live mobile videoconferencing and consultation in order to assist medical first responders during transit.[51] Satellites could also be used in the future to set up telemedicine systems just outside the hot zone to provide care for victims of a public health emergency.[52] Such satellite telemedicine systems would connect physicians across the country with emergency response providers and could obviate the need to move a large number of physicians near the hot zone.

D. Mass Communications

Satellite systems have been used to broadcast information to the public and to emergency service providers during crises and natural disasters. Satellite television[53] and satellite radio[54] are now integrated into the national Emergency Alert System (EAS).[55] During the aftermath of hurricane Katrina, satellite television and radio provided around the clock information on recovery and relief efforts, including to areas where terrestrial broadcasting facilities were limited or inoperable.[56] Satellite television and radio

[49] *See e.g.*, IBFS File Nos. SES-STA-20050907-01217 (granting special authority to operate ten conventional Ku-band VSAT remote .96 meter terminals to reinitiate services lost by hurricane Katrina); SES-STA-20050930-01348 (granting special authority to operate a 2.4 meter conventional C-Band transmit/receive earth station on an oil platform in the Gulf of Mexico to provide digital voice and data services).

[50] Iridium Comments at 4 (noting use of MSS system with medevac helicopters to transmit information such as flight times, text messaging, weather requests, maintenance requests, engine monitoring, flight tracking, medical emergency support, and email).

[51] *See* Peter J. Brown, "Satellites Stand By High Above the Hot Zone," Via Satellite, August 2005 at 33 (noting use of MSS systems to provide multiple video feeds from cameras installed in the back and sides of ambulances to allow remote visual and voice monitoring of the emergency scene and of the patient during transit).

[52] *See id.*

[53] Satellite television consists of the Direct Broadcast Satellite (DBS) service and Direct-to-Home (DTH) service. DBS and DTH chiefly utilize GSO satellites. The distinguishing feature between DBS and DTH services is the frequency band used for transmissions to the subscriber. DBS operates its transmissions to subscribers in the 12.2-12.7 GHz frequency band, whereas DTH operates subscriber transmissions in the C-, Ku-, and Ka-bands.

[54] Satellite radio, or Satellite Digital Audio Radio Service (SDARS), is a new radiocommunication service in which audio programming is digitally transmitted by one or more satellites directly to subscribers at home, in cars, and elsewhere. 47 C.F.R. § 25.201. SDARS can be provided by both GSO and NGSO satellites.

[55] Review of the Emergency Alert System, *First Report and Order*, EB Docket No. 04-296, ___ FCC Rcd ___, FCC 05-191 (rel. Nov. 10, 2005).

[56] DirecTV News Release, "DIRECTV Launches Dedicated 'Hurricane Katrina Information' Channel," September 2, 2005, available on-line at http://www.techweb.com/wire/ebiz/170700326; Press Release, "Red Cross Radio Launches on XM Satellite Radio", September 7, 2005, available on-line at http://www.xmradio.com/newsroom/press_releases.jsp. XM Radio also offers an Emergency Alert Channel (XM Channel 247), which provides warning of natural disasters and provides updates on clean-up, road closures, school closings, and other information from federal and local governments, law enforcement, and other agencies. *See id.*

were also used to relay information from FEMA to evacuees and relief works in shelters.[57]

E. Satellite Imaging and Damage Assessment

Earth Exploration Satellite Service (EESS) provides satellite imagery of the earth that is often combined with terrestrial data, geographic information, and lower-altitude images taken from aircraft.[58] Emergency first responders often rely on EESS imagery for wide-scale mapping of hurricane and flood impact zones. For example, satellite imaging was used by the Civil Air Patrol (CAP) to determine the extent of the damage caused by hurricane Katrina.[59] Satellite imagery can be available in near real-time, which allows emergency operations centers to better plan assistance for disaster victims and assess property damage.[60]

F. Asset Tracking and Navigation

Commercial MSS networks facilitate automatic vehicle location systems that relay the positions of emergency vehicles to a central location, allowing dispatchers to find quickly the closest available unit to respond to a call; to view all vehicles as they travel emergency routes and to evaluate the efficiency of the response in transit; and to adjust route directions to real-time traffic conditions. Automatic vehicle location uses satellite global positioning systems to pinpoint the precise location of each emergency vehicle. This satellite-based technology provides real-time location and direction of traveling vehicles. With the increased capability that automatic vehicle location systems provide, emergency agencies can more effectively coordinate emergency efforts with other agencies.[61] Satellite-based vehicle tracking systems also facilitate secure transportation of dangerous and high-value loads. Satellites are also essential to tracking maritime assets in transit, both for port security purposes and for shipping companies' load management.

The Radio Navigation Satellite Service (RNSS)[62] provides enhancements to the U.S. Global Positioning System and is key to the Federal Aviation Administration's Wide-Area Augmentation System

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[57] FEMA News Release, "Dish Satellite TV Network And XM Satellite Radio Deliver FEMA Information To Shelters," September 17, 2005, available on-line at http://www.fema.gov/news/newsrelease.fema?id=18980.

[58] The EESS is a radiocommunication service between earth stations and one or more space stations, which may include links between space stations, in which: (1) information relating to the characteristics of the Earth and its natural phenomena, including data relating to the state of the environment, is obtained from active sensors or passive sensors on Earth satellites; (2) similar information is collected from airborne or Earth-based platforms; (3) such information may be distributed to earth stations in the system concerned; and (4) platform interrogation may be included. EESS can be provided by both GSO and NGSO satellites.

[59] *See* "CAP Assessing Hurricane Impact in Florida," available on-line at http://www.cap.gov/sdis/.

[60] *See id.* Next-generation EESS satellites recently licensed by the FCC will make possible even shorter turnaround time for images of developing catastrophic events, as well as sub-meter resolution of images. *See, e.g.*, DigitalGlobe, Inc. Modification of Authorization to Construct, Launch and Operate a Remote-Sensing Satellite System, *Order and Authorization*, 20 FCC Rcd 15696 (IB 2005) (authorizing the launch and operation of three NGSO satellites to further the delivery of enhanced next-generation imaging services to government and commercial users).

[61] For more information, see U.S. Department of Transportation, Intelligent Transportation Systems project, available on-line at www.its.dot.gov.

[62] Radio Navigation Satellite Service (RNSS) uses the propagation properties of radio waves for the determination of the position, velocity and/or other characteristics of an object. *See* 47 C.F.R. § 2.1(c).

(WAAS). WAAS provides an extremely accurate navigation system for civil aviation and allows precision landing approaches in all weather conditions at all locations throughout the United States.[63] Such capability would greatly enhance the ability of emergency response providers to reach affected areas, where terrestrial aircraft navigation systems have been degraded or rendered inoperable. The Commission has recently granted an authorization for operation of an new RNSS space station, which was successfully placed into orbit on September 9, 2005.[64]

III. Conclusion

The record in this proceeding reflects the fact that commercial satellite services are already being used by emergency response providers as part of their emergency communications networks, either as stand-alone platforms or as part of an integrated satellite-terrestrial network. In addition, recent disasters such as hurricane Katrina have highlighted the ability of satellite services to continue operating when existing terrestrial infrastructure is non-existent or has been degraded or destroyed. Increased integration of commercial satellite services as a key component of interoperable, multi-platform emergency response networks seems likely, especially as emergency response providers become increasingly familiar with the capabilities of satellite service providers. Furthermore, commercial satellite operators are poised to provide interoperable, broadband mobile communications infrastructure based on the high degree of flexibility permitted within the commercial satellite spectrum, enabling new commercial satellite technologies to develop and become affordable as "off-the-shelf" solutions to the needs of emergency response providers.[65]

[63] For more information, see U.S. Federal Aviation Administration, WAAS project, available on-line at http://gps.faa.gov/Programs/WAAS/waas.htm.

[64] *See* Lockheed Martin Corp., *Order and Authorization*, 20 FCC Rcd 14558 (IB Sat. Div. 2005).

[65] *See* MSV/Hatfield White Paper at 12 (noting that hybrid satellite-terrestrial systems would enable public safety agencies "to benefit from the considerable economies of scale and enhanced functionalities that commercial providers can offer"); SIA Comments at 7-8 (noting that public safety agencies will benefit from the next generation mobile-satellite systems that will offer smaller, lighter, and more powerful portable terminals).

Appendix D

Projects to Enhance Capabilities of Emergency Response Providers

State and local public safety entities have explored various innovative approaches to improve interoperability and communications capacity. Some of these solutions involve sharing spectrum, infrastructure, or both, with federal or private users, as discussed previously in the report. Other projects or proposals, some of which would require additional allocations of public safety spectrum, utilize advanced technologies to improve public safety communications systems. Set forth below are examples of recent efforts to enhance the capabilities of emergency response providers:

Washington, D.C.'s Office of Chief Technology Officer Program. Motorola and FPIC contend that a trial program known as WARN (Wireless Accelerated Responder Network), operated by the Washington, D.C. Office of Chief Technology Officer (OCTO) pursuant to temporary, experimental licenses issued by the Commission, shows significant promise. Motorola describes the OCTO program as a pilot project for a citywide broadband wireless system to provide emergency response providers the ability to use video communications and other technologically advanced applications to enhance public safety.[1] FPIC states that OCTO demonstrates "full, core data communications interoperability."[2] Motorola adds that "implement[ing] such wide-area systems on a regional/metro basis [would] require . . . more dedicated spectrum."[3] According to the Spectrum Coalition, the OCTO trial network is an Internet Protocol (IP) network that "can more easily support any combination of data, video and voice traffic, and is particularly well equipped to extend any desktop applications to deployed first responders."[4] Spectrum Coalition explains that because the OCTO program runs on a private network as well as part of the Washington, D.C. government's wide area network, which uses firewalls and IP addresses, OCTO is "intrinsically safer than a commercial network."[5] Further, the coalition stresses that the D.C. pilot network makes clear that "sustaining broadband data connections require much greater signal levels than do narrowband voice" and thus "additional permanent 700 MHz spectrum is needed."[6]

Statewide Wireless Network - New York. According to NYOT-SWN, the state of New York plans to build a Statewide Wireless Network (SWN). NYOT-SWN reports that the SWN will provide digital, trunked architecture that will offer both voice and data capabilities for disaster and emergency situations and for enhancement of international coordination along the U.S./Canadian border.[7] NYOT-SWN states that its proposed network seeks to fill "an increased need for specialized communications capabilities and for interoperability between agencies."[8] The office asserts that, as the number of local agencies on the

[1] Motorola Comments at 7, n.13.

[2] FPIC Comments at 5.

[3] Motorola Comments at 6. *See also* Spectrum Coalition Comments at 12-13.

[4] Spectrum Coalition Comments at 12.

[5] *Id*.

[6] *Id*. at 13-14. We note that the Spectrum Coalition also filed a white paper in the instant docket. *See* Letter from Bill Butler, Spectrum Coalition for Public Safety, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 05-157 (Oct. 27, 2005) (appending *Public Safety Spectrum: How Much Do We Need for Data?*) (Spectrum Coalition White Paper).

[7] *See* NYOT-SWN Comments at 2.

[8] *Id*. at 4.

planned system increases, migrating from VHF and UHF channels, the system will require "additional channels to support the traffic loading increases" in more highly populated areas, and adds that the "use of inter-system gateways as a mechanism to bring non-SWN systems on to the SWN will require additional channels."[9] NYOT-SWN submits that additional channels for the SWN will "need to come from spectrum that is immediately proximate to the current 700 and 800 MHz public safety bands."[10]

The Capital Wireless Integrated Network. The Capital Wireless Integrated Network ("CapWIN"), offers interoperable first responder data communication and information sharing through a suite of applications to the law enforcement agencies located in Maryland, Virginia and Washington, D.C.[11] According to its website, public safety agencies in these regions connect to CapWIN either over a "hard wired connection" from an agency's network or a "wireless connection such as 802.11x, CDPD, CDMA (1xRTT, EDVO), GSM, GPRS, 800 MHz or other wireless infrastructure,"[12] and have access to (1) private and Internet Virtual Private Networks (VPNs) that connect to participating agencies' networks and wireless service providers; (2) redundant configurations to ensure operation during hardware, software or power failure; (3) extensive use of commercial-off-the-shelf software; and (4) an open scalable, reliable Web-based architecture.[13] Among other tools, CapWIN's application suite enables incident management and coordination across agencies, regions, and public safety and transportation disciplines and provides secure one-to-one and group public and private discussions.[14] FRC reports that CapWIN "enable[s] and enhance[s] communications for first responders during critical incident responses by integrating data and messaging systems in the first multi-state, inter-jurisdictional transportation and public safety integrated wireless network in the United States."[15] NY Westchester County adds that the CapWIN application is an "enormous success" for these jurisdictions, "even though they are dependent upon a variety of commercial communications services."[16]

Mobile Satellite Service - New Mexico State Police. With respect to statewide programs, MSV provides service to the New Mexico State Police Department (New Mexico State Police). The New Mexico State Police use MSV's satellite Push-to-Talk and data services to enhance the force's communications capabilities across the remote and rural parts of the state.[17] According to MSV, without this use of satellite technology, the New Mexico State Police LMR system would not reach fifteen percent of the state, and would be limited to voice communications.[18] MSV explains that its satellite system, together with an Ancillary Terrestrial Component (ATC), provides numerous benefits, including the fact that the system can be used when the power grid fails because ATC handsets can "switch seamlessly between the terrestrial network (when a base station is operating nearby) and a satellite network (when

[9] *Id*.

[10] *Id.*

[11] *See* http://www.capwin.org.

[12] *See id*.

[13] *See id*.

[14] *See id.*

[15] FRC Comments at 2-3.

[16] NY Westchester County Comments at 5.

[17] *See* MSV Comments at 11.

[18] *See id.* at 3, 11.

there are no base stations in the area)."[19] MSV also states that its system permits emergency response providers to have priority access coverage, and provides the flexibility to create ad hoc user groups with Push-to-Talk functionality through a large group dispatch service.[20]

Los Angeles County Spectrum Efficiency Demonstration System. Consulting firm Interoperable Wireless suggests that Congress consider designating Los Angeles County as the site of a proposed national Spectrum Efficiency Demonstration System (SEDS).[21] Interoperable Wireless submits that its proposal to deploy the firm's SEDS project in Los Angeles County would demonstrate that spectrum efficiency techniques used in the UHF and VHF bands would be suitable for deploying high-speed data services.[22] Specifically, Interoperable Wireless reports that the firm's "spectrum efficiency techniques … can be combined to compress 80 MHz or more of public safety voice services into only 8 MHz. This in turn will open up 40 to 50 MHz of *current* spectrum in VHF/UHF now used for public safety voice for desperately needed high speed data services – far more than the 12 MHz currently allocated by FCC/NCC in the elusive 700 MHz band."[23] The firm also explains that this project would create a spectrally efficient template in Los Angeles that could be replicated elsewhere, would serve to resolve spectrum scarcity, create interoperability, and open economies of scale for purchasing equipment and obtaining funding.[24]

[19] *See id*. at 11-12.

[20] *See id.*

[21] *See* Interoperable Wireless Comments at 23.

[22] *See id*. at 23.

[23] *Id.* (emphasis in original).

[24] *See id*. at 24.

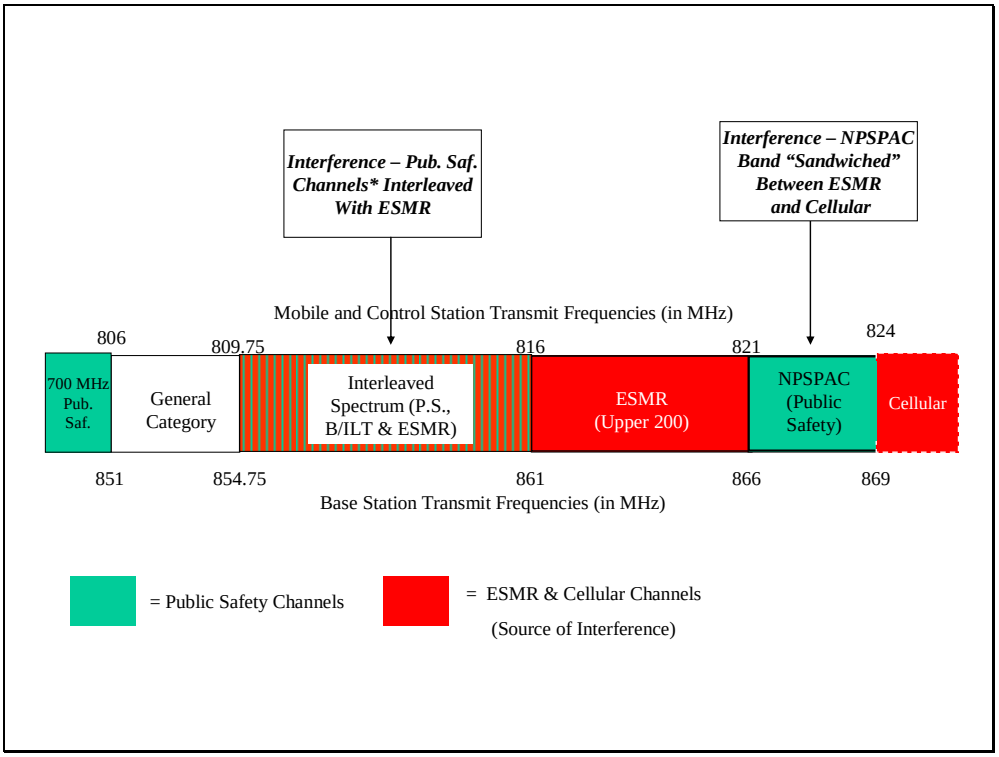
Appendix E

Improving Public Safety Communications in the 800 MHz Band

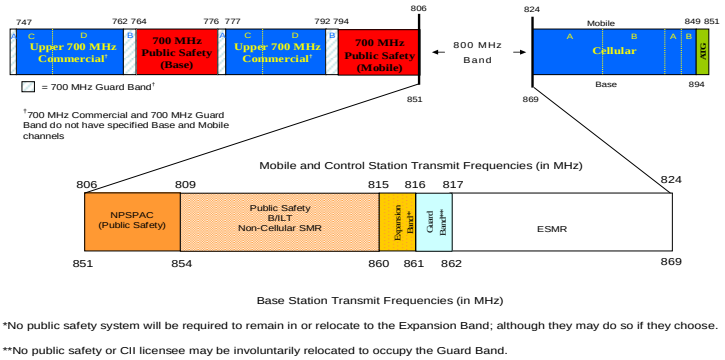
New band plan. On July 8, 2004, the Commission adopted the *800 MHz Report and Order (800 MHz R&O)* providing a two-pronged solution to the problem of 800 MHz band public safety radio systems receiving interference. First, the Commission adopted a plan to reconfigure the 800 MHz band to separate public safety and Critical Infrastructure Industry (CII) entities from commercial wireless carriers, such as Nextel. Second, the Commission adopted a specific technical standard regarding what constitutes unacceptable interference to emergency response providers and CII (*e.g.*, utilities) and holds commercial carriers strictly responsible for complying with this standard.

On December 22, 2004, the Commission released the *800 MHz Supplemental Order* that reaffirmed, modified, and clarified certain aspects of the *800 MHz R&O*. On October 5, 2005, the Commission addressed petitions for reconsideration of the *800 MHz R&O* and the *800 MHz Supplemental Order* as well as a request for waiver and a request for declaratory ruling in a *Memorandum Opinion and Order* in the 800 MHz proceeding.

Under the previous band plan, the 800 MHz band was configured as follows:



Under the new band plan adopted in the *800 MHz R&O*, the 800 MHz band will be configured as follows:

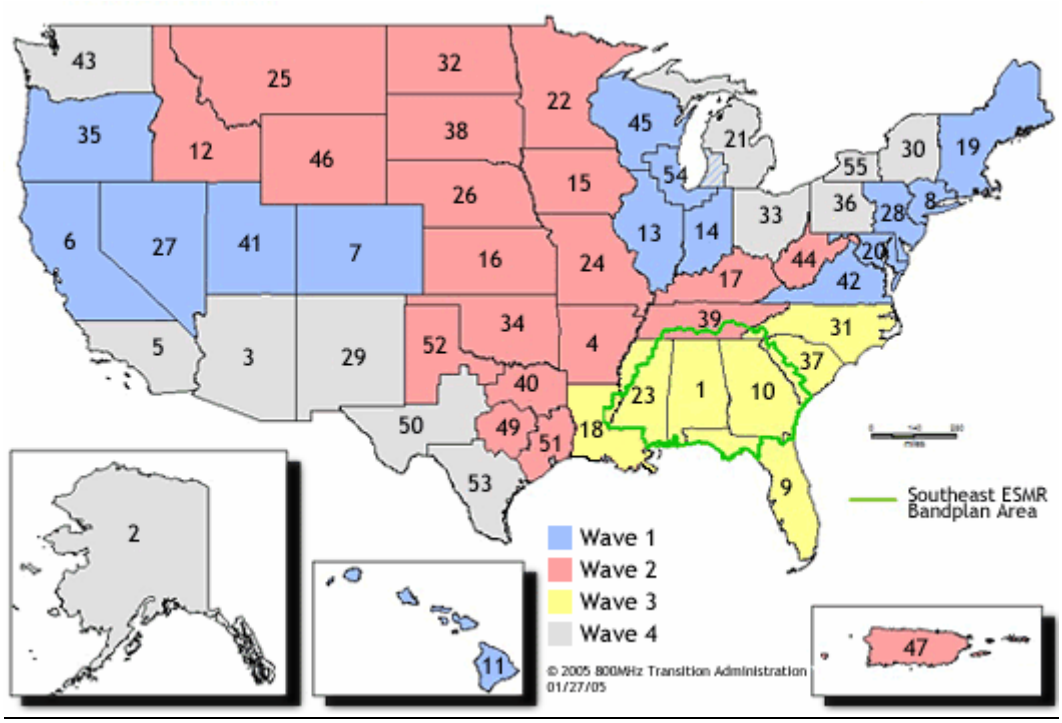


*No public safety system will be required to remain in or relocate to the Expansion Band; although they may do so if they choose.

**No public safety or CII licensee may be involuntarily relocated to occupy the Guard Band.

Transition. On October 29, 2004, the Commission approved a Transition Administrator (TA), an independent party responsible for managing the relocation process and ensuring a smooth transition to the new 800 MHz band plan. The TA is presently tasked with the administration and financial aspects of the band reconfiguration process to ensure that reconfiguration is achieved with minimal disruption to licensees, particularly public safety entities.

- On March 11, 2005, the Commission approved the basic reconfiguration schedule developed by the TA. Band reconfiguration will occur on a NPSPAC-by-NPSPAC-region basis. The TA reconfiguration plan assigns each of the fifty-five NPSPAC regions to one of four staggered "prioritization waves" as shown in the map below.



- On May 27, 2005, the Wireless Telecommunications Bureau (Bureau) released a PN announcing a June 27, 2005 start date for the band reconfiguration (non-NPSPAC channels) for NPSPAC regions assigned to Wave 1. The PN also started the 36-month clock for completion of the band reconfiguration.
- On September 2, 2005, the Bureau released a PN announcing an October 3, 2005 start date for the band reconfiguration (non-NPSPAC channels) for NPSPAC regions assigned to Wave 2. The PN also moved the Louisiana NPSPAC region (#18) from Wave 2 to Wave 3.
- On December 2, 2005, the Bureau released a PN announcing an January 3, 2005 start date for the band reconfiguration (non-NPSPAC channels) for NPSPAC regions assigned to Wave 3.